Contemporary Issues in Technology Education

Marion Rutland
Angela Turner *Editors*

Food Education and Food Technology in School Curricula

International Perspectives

Springer

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Contemporary Issues in Technology Education - About this series

Technology education is a developing field, new issues keep arising and timely, relevant research is continually being conducted. The aim of this series is to draw on the latest research to focus on contemporary issues, create debate and push the boundaries in order to expand the field of technology education and explore new paradigms. Maybe more than any other subject, technology education has strong links with other learning areas, including the humanities and the sciences, and exploring these boundaries and the gaps between them will be a focus of this series. Much of the literature from other disciplines has applicability to technology education, and harnessing this diversity of research and ideas with a focus on technology will strengthen the field.

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Foreword

It is not unusual for people to hold strong views about food. These passions and prejudices may stem from early childhood experiences within a family setting. They may be informed by years of study and research. They are almost certainly shaped by place and time—and frequently by inspiring and influential individuals.

Historically, Food Education in schools was classified as practical, skill-based cookery lessons. There is much still to admire in this approach. It can provide challenging and rewarding life skills for young people who do not necessarily thrive in a more academic environment. It can lead on to a vocational pathway to employment, often in the catering or food product development industries.

Forward thinkers have grasped opportunities to explore new processes, sustainable ingredients, and modern technologies to move Food Education into exciting approaches appropriate to the twenty-first century. Research findings on nutrition have had a powerful impact on understanding of healthy eating, recipe development, and product reformulation alike. This is a progressive and dynamic area for refreshing and updating Food Education which some countries have embraced.

It is sometimes a criticism of Food Education in schools that it lends itself to such a wide range of applications in the curriculum. (This can be achieved particularly well in some primary schools.) The dilemma here is that it is all too often assumed that it can be taught by teachers lacking subject-specific training. On the plus side, however, learning about food has a clear and positive role which can enhance and enrich lessons in Science, Design, and Technology and Personal, Social, Health and Economic education (PHSE).

The vital role played by appropriately trained and experienced teachers who both educate and inspire the children and young people they teach should not be underestimated. A background as a Nutritionist, Caterer, or in Food Manufacturing or Retail can be valuable. As can knowledge of local culture and food production methods. It is interesting to learn how colleagues inspire new teachers and refresh the more experienced ones through Initial Teacher Education and Continuing Professional Development.

There is clearly much of value to be retained from traditional approaches to Food Education, whilst simultaneously rising to the challenge of keeping this dynamic and rapidly changing area relevant and up to date. It is fascinating to learn from colleagues who are so generously willing to share their experiences from a variety of different environments…their successes and their issues.

This book has something to engage all those with a constructively critical approach to Food Education and Food Technology, in whatever guise it appears in the school curriculum, and a sufficiently open mind to seek out stimulating ways forward. There will be lone teachers in isolated schools who will feel comforted that what they are doing now is sound and encouraged to be a little more adventurous in future. Colleagues with responsibility for curriculum design at both local and national policy level will benefit from better understanding of the challenges of teaching such a time-sensitive practical subject and value the sense of achievement so many pupils and young people gain from this experience.

There is much for teacher educators, providers of in-service professional development, and external examination developers to reflect upon and some inspirational new ideas to "share." Reflection is a valuable learning experience, whereas complacency is not. So, where should we be heading in the next few decades? Clearly one size does not fit all. Thought provoking!

Stephanie Valentine
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About the Authors

David Barlex is an acknowledged leader in design and technology education, curriculum design and curriculum materials development. He taught in comprehensive schools for 15 years before taking university positions in teacher education. He directed the Nuffield Design and Technology Project. David is well known for developing curriculum materials that support pupil learning from a constructivist perspective. He uses this approach to develop young peoples' ability to understand and critique the design decisions made by professional designers and those they make themselves.

Martin Caraher is Professor Emeritus Food and Health Policy at the Centre for Food Policy, School of Health Sciences, University of London. Martin has worked in the area of food and policy for over 30 years, publishing his first piece on cooking in 1999. He has an interest in skills, home economics and community food and has concerns with single issue solutions being offered as magic bullets to issues such as obesity.

Bev France is Associate Professor in the Department for Curriculum and Pedagogy in the Faculty of Education and Social Work at Auckland University, New Zealand. Her passion to improve communication about science based technology solutions was lit duing the 1990s when she embarked on her PhD research on the teaching of biotechnology in New Zealand. Since then, the focus of her research and teaching has been to develop a pedagogy that enhances this process.

Vanessa Grafham trained as a Design and Technology teacher, specialising in food technology, in 2000. For the majority of her teaching career she has taught in a girls' secondary school in the London area. Currently, she is the subject lead for Design and Technology within her school. Prior to teaching, she worked in industry as a nutrition adviser for the Milk Marketing Board and continues to draw on these experiences in her present teaching role.

Bronwyn Graham careers in the food industry have spanned most of her life. She started as a 15 year old in a local fast food shop, moving into catering in her 20s, studying and working in food science and then into food education in Australia. Bronwyn's knowledge and understanding of food careers has been gained via her own experiences.

Mishack T. Gumbo is a Full Professor in the Department of Science and Technology Education at the University of South Africa's College of Education. He is also a Coordinator of the Master's and Doctoral Programme in the College. His research specialisation fields include technology teachers' continuing professional development, indigenous knowledge and the curriculum, decolonisation of the curriculum, distance education and e-learning. Mishack has published numerous scholarly articles, conference papers, book chapters and three co-edited scholarly books. He has given keynote addresses at conferences and other academic occasions, mentored developing researchers and post-doctoral fellows. He leads a community engagement on Strategic Intervention in Mathematics, Science and Technology Education.

Suzanne Lawson is the PGCE secondary course leader at the University of Worcester. Previous to this, she worked as a senior lecturer at Birmingham City University. She has 14 years teaching experience working in a range of schools in the UK with a further 15 years' experience in teacher training.

Sue Miles-Pearson a former primary school teacher for 6 years in London, has worked in initial teacher education at the University of Roehampton, London for the past 14 years. She is the module convenor for primary design and technology, teaching both undergraduate (a 3 year degree) and post graduate students. Sue has written several articles about computer aided design and computer aided manufacture and the teaching of food technology. She also has co-authored a book chapter published on teaching creatively and teaching for creativity within primary design and technology.

Suzanne Piscopo is an Associate Professor in Nutrition, Family and Consumer Studies, mainly training Home Economists, Home Economics teachers and early childhood educators at the University of Malta. She is a frequent guest speaker in school and community events and on the mass media, tackling subjects related to food, health and sustainable consumption.

Amanda McCloat is a Home Economist with a particular research interest in Home Economics and food education; food and cooking skills; and Education for Sustainable and Responsible Living. She is involved in Home Economics at an international level as the European Representative on the Executive Committee of the International Federation for Home Economics (IFHE).

Donna Owen is a secondary teacher currently working in a Sydney, Australia high school and an academic writer. She is passionate about food education and teaching the next generations of students. She understands as a food educator, the importance of teaching food to students that is relevant and engaging in order to remain open and flexible to the ever-changing needs of the time".

Sue Reeves is Principal Lecturer and Head of Undergraduate Provision and Student Experience in the Department of Life Sciences at the University of Roehampton, London where she teaches Nutrition and Health. She is a Fellow of the Association for Nutrition and a Senior Fellow of the Higher Education Academy.

Christopher Ritson is Emeritus Professor of Agricultural Marketing and former Dean of the Faculty of Agriculture and Biological Sciences at Newcastle University, UK. He has published widely on aspects of Food Economics, Food Policy, Food Marketing, and Food Ethics. He has served on various food related Advisory Committees and is currently a member of the Food Standards Agency Advisory Committee on Novel Foods and Processes.

Marion Rutland is a former Principal Lecturer and Honorary Research Fellow at the University of Roehampton, London, UK. Prior to this, she taught food related subjects for 20 years in a range of secondary schools in the UK, Sydney, Australia and was an Advisory Teacher for Information Communications Technology in London. Her educational research interests include food education, curriculum development, teaching and learning in design and technology and creativity.

Carly Saunders is a high school Food Technology teacher, University Lecturer of Food Technology teaching and the founding director of Teacher Professional Development, a company that provides teachers with teaching strategies, resources and professional development days. Teacher Professional Development is endorsed and registered by New South Wales Education Standards Authority in Australia.

Ruth Seabrook taught for 10 years in all areas of design and technology (D&T), with Food and Textiles Specialisms, in the secondary school sector in the UK. She moved to work with initial teacher education trainees at the University of Roehampton, London in 2009 as the course leader for the Postgraduate Certificate of Education (PGCSE) in D&T.

Wendy Slatter is a New Zealand-educated technology education specialist. She has 20 years classroom experience as a foods and fabric technology teacher. Her research interests include teacher access to communities of practice and components of technological food literary. She conducts freelance advisory work with New Zealand technology teachers.

Gillian Stuart is an award winning educator, special educational consultant, Principal and proven leader with a career in using physical activities and food applications to improve learning outcomes. Gillian was unanimously endorsed in 2018 by her colleagues as a worthy recipient for leading best practice, in Aboriginal Education in New South Wales, Australia

Deborah Trevallion is tenured at The University of Newcastle where she researches, lectures and coordinates undergraduate and postgraduate programs and courses in all areas of Technology Education. Deborah shares her passion for Technology Education and has 40 years' experience in universities and secondary schools. Deborah's doctoral thesis explores the factors affecting the changing professional identity of Technology Teachers. She has written two best-selling secondary senior textbooks, chapters in texts and is regularly published in education journals

Angela J. Turner initially studied food science at Reading University, UK and worked in the food industry before leaving to travel and explore the world. She returned and trained to become a teacher of the new design and technology subject. Angela has been teaching for 30 plus years in London schools and worked in Bromley Local Authority, London as a consultant for 8 years. She then returned to full-time teaching at an inner London academy school and is now working at Dartford Grammar School for Girls.

Angela Turner is a teaching/research scholar in the School of Education, Southern Cross University, NSW Australia. Her work involves interdisciplinary and cross cultural teaching contexts as ongoing enterprise to inform teaching, learning and assessment practice. Core to this includes ontological meaning making on food sustainability in the context of food education.

Susan Wood-Griffiths was the PGCE Secondary Design and Technology subject leader at the University of Worcester until 2018. Before moving into Higher Education, she taught for 21 years in the UK and overseas. Sue has worked with many teachers and aims to develop innovative, creative teachers who share ideas and take 'intelligent' risks.

Chapter 1
Introduction

Marion Rutland and Angela Turner

Abstract The book has been designed to be of relevance to teachers in post, teacher trainers, pre-service teachers, curriculum developers, Continuing Professional Development (CPD) providers, educational researchers and educational policy makers. The structure of this book contains acknowledged experts in the fields of food education who contribute chapters supported as far as possible by evidence from actual experiences and research. The target audience are teachers, trainee teachers, and teacher educators but will also make it relevant to educational policy makers, researchers and potential researchers.

Keywords Food education · Primary and secondary curriculum · Food teaching Food teachers' professional identity · Contemporary issues

This book draws together the perceptions and experiences from a range of international professionals with specific reference to food education and considers food education in schools and how it is taught across a range of countries. It presents a variety of teaching, learning and curriculum design approaches relating to food across primary, secondary and vocational school education, undergraduate initial teacher education programs and in-service professional development support contexts. The authors include senior and middle managers and teachers in schools, undergraduate university lecturers and pre-service teacher educators, researchers, continuing teacher development (CPD) trainers, curriculum advisers and external examination developers. Individual chapters will be influenced by the author's background and country of origin, each of whom contributes a different and valued

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voice to the whole composition of this book. In doing so, a reflective untangling will orientate the reader on what the authors consider the purpose of food education is; what children and young people should learn, understand and be able to do; why it is important; and how teaching food education can be achieved effectively. These narratives offer insight into some of the diverse issues in food education internationally and lessons to be learned from successes and failures, including action points for the future.

Part I: Food Teaching in Primary and Secondary Schools in Different Cultures

This part will explore a range of curriculum approaches in primary and secondary food education in England, Ireland, New Zealand, Australia and Malta**.**

Chapter 2: Exploring Food Education in the English Primary Curriculum
There have been a lot of changes over the years within the English primary education system. This chapter investigates what impact this has had on design and technology (D&T) and in particular the food technology education element. It reflects on research completed in 2009 on teaching food education with university initial teacher education (ITE) trainee teachers and replicates this research 10 years later. In the second part of the chapter 25 primary schools across England were contacted to find out just what food education is being taught and how it varies throughout the age phases. The expectation is to gain an overview and a better understanding of what changes have occurred during the last 10 years and what food education is currently being taught and consider the impact of the current dominant focus of literacy and numeracy in English primary schools.

Chapter 3: Reducing Challenging Behaviour and Maintaining Aboriginal and Torres Strait Islander (ATSI) and non ATSI Student Retention Through Food and Exercise in Primary Schools in New South Wales, Australia
This chapter focuses on joint cross-cultural multidisciplinary teaching and learning contexts of research projects and initiatives in primary schools in New South Wales, Australia. The focus is on Maslow's hierarchy of needs, and the purpose is to promote health-based education programs that engaged and supported positive student outcomes, through breakfast and lunch programs and morning exercise routines.

Chapter 4: What Is the Current State of Play for Food Education in English Secondary Schools?
Secondary school food teachers in England have recently faced a period of unprecedented change, with fundamental changes to the national curriculum (NC) for design and technology (D&T) and for food technology. This chapter will explore 'the current state of teaching food' in secondary schools in England and review research findings based on case studies provided by a range of food teachers in secondary schools.

Chapter 5: A Technological Approach to Secondary Food Education in New Zealand

This chapter examines the issue of secondary food education in New Zealand, reviewing the past and exploring the current situation. It explores a theoretical model that presents food as a technological outcome. Specific reference is made to what components of food could be taught to students at junior secondary level (12–14 years).

Chapter 6: Developments in Secondary Food Education in England Since the 1970s: A Personal Perspective

This chapter explores the author's personal perspectives of food education in English schools and how it has evolved from domestic science in the 1970s through being part of design and technology (D&T) in the national curriculum to more recent trends where the subject has separated from D&T with the introduction of General Certificate of Secondary Education (GCSE) in Food Preparation and Nutrition for pupils aged 14–16 years. It is a personal tale, drawing on experiences as a pupil, as a graduate in the food industry and as a teacher working in and around London for more than 25 years.

Chapter 7: Food and Nutrition Education in Malta: A Journey Across Time and Subject Boundaries

This chapter presents a historical overview of how food and nutrition education evolved in Malta, looking at its original goals of life skills, health improvement and potential employment and the eventual diversification in focus and target learners in tandem with emerging needs and policies. It then offers a detailed description of the current provision of food and nutrition education in secondary schools.

Chapter 8: Home Economics Education in Secondary School Settings: Lessons from Education Policy on the Island of Ireland

The teaching of home economics in secondary school education is discussed in two jurisdictions on the Island of Ireland—the Republic of Ireland and Northern Ireland in the UK. The educational rationale, aims and underlying pedagogical approaches to teaching home economics in educational policy in both jurisdictions are explored and comparative case study similarities and differences highlighted.

Part II: The Professional Identity of Food Teachers

This part will look at the influences in schools, higher education, initial teacher education, continuing professional development (CPD) and vocational programmes on the identity of food teachers in different countries, contexts and cultures.

Chapter 9: Positive Ingredients to Redefine Food Education in Schools in New South Wales, Australia

The focus of this chapter is to draw upon research and surveyed reflections from current food teachers in schools in New South Wales, Australia. The aim is to use this lens to unpack the key influencing factors that will keep food education in NSW, Australia, evolving and relevant for the next generation of food students and teachers.

Chapter 10: Where Will Future Secondary Food Teachers Come from in England?
This chapter asks 'where will future secondary food teachers come from in England?' It tracks the evolution of food teaching in the curriculum tracing its origins in domestic science through to the present focus on food, nutrition and preparation and focuses on the key issue that in order to deliver a quality food curriculum in English schools we need skilled food teachers.

Chapter 11: Changing the Professional Identity of Food Technology Teachers in New South Wales, Australia
If a pre-service technology teacher is to teach food technology within technology education (TE) using a holistic approach, then the advancement of their professional identity as a technology teacher will be reliant upon the grasping of essential technology education concepts. During the period that this research was undertaken, 2012–2017, TE underwent major curriculum changes, and this succession of curriculum change generated high levels of tension and confusion. This chapter discusses the factors that shape the professional identity of pre-service technology education (TE) students who are transitioning at university in order to become secondary food technology teachers to support the modifications to the TE curriculum, particularly food technology (FT) in New South Wales, Australia.

Chapter 12: Qualifications for Working in the Food Industry: Understanding All the Available Options for Students and Educators in Victoria, Australia
The Australian food industry is vast in its operations and opportunities. It is an industry that can cater to the career or employment needs of almost any person, with almost any skill level and capability. It offers opportunities for unskilled workers as well as for those highly skilled and highly educated. This industry is therefore uniquely placed for the opportunities it offers for the wide range of communities it services. Food education at secondary school level has undergone significant changes in recent years in Victoria, Australia. The vocational education and training (VET) sector is a largely misunderstood study option, with very relevant job outcomes and also pathways to further education. These will be examined and discussed in detail in this chapter.

Chapter 13: Continuing Professional Development for Secondary Food Technology Teachers in New South Wales (NSW), Australia
One of the most significant findings discovered by registered providers of secondary teacher in professional development in New South Wales, Australia, is the varying degrees of teacher knowledge across the diverse topics covered in the New South Wales (NSW) 7–12 syllabus. This chapter aims to examine the needs of teachers in preparing their food technology students for the future through qualitative research surveys of 241 NSW teachers and observational research of the 1066 attendees to teacher professional development courses.

Chapter 14: Food Education in Upper Secondary English Schools: Progression into Food-Related Undergraduate Courses in Higher Education
This chapter looks at food teaching in English schools with specific reference to the loss of an advanced (A) level food technology course for pupils aged 16–18 years. A review of university undergraduate food-related courses is followed by an investigation of A level courses taken by students before entry to food-related university undergraduate courses and a small-scale research project exploring the potential content of a new A level food examination, a course that could act as a pathway to undergraduate courses and a range of employment in nutrition, dietetics, nursing, health-related professions, teaching and the food industry.

Part III: Current Content and Contemporary Issues

This part will explore current curriculum approaches in food education for the teaching of food skills and knowledge, food technology, nutrition and health, biotechnology, global food supplies and teaching food in the UK, New Zealand and indigenous cultures in South Africa and Australia.

Chapter 15: Current Research in Nutrition in the School Curriculum in England
Food and nutrition is taught in England in different areas of the school curriculum, namely, science, design and technology and also personal, social, health and economic (PSHE) education. This chapter aims to highlight developments in nutrition research and how this can be used to help shape and strengthen the teaching of food and nutrition in schools.

Chapter 16: A Curriculum Developer's Perspective on the Place of Food in the Secondary School in England
This chapter begins by considering the importance of food education in English secondary schools in the context of the obesity crisis and the role of meat production in contributing to global warming. It continues with a discussion on how young people might be taught to cook and eat well. This is extended with a consideration of the role of science learning in meeting these objectives and the possible content of food technology courses.

Chapter 17: Population Growth and Global Food Supplies
The chapter will explain why the nineteenth-century political economist, Thomas Malthus, believed that population growth would outstrip the capacity of the planet to feed everyone and why this "Malthusian" vision of the future has not materialised. It will then review an accumulation of recent evidence, which suggests a potentially disturbing picture of the future balance between global food supplies and population growth.

Chapter 18: Socially Acute Questions: How Biotechnology Can Provide Context and Content for Discussion in Food Technology Education
Biotechnology education provides a rich source of socially acute questions that can be asked about the risks, moral issues and legitimacy of many foods being labelled 'pure' and 'natural'. This chapter will explore some of the issues of genetically engineered foods and provide some pedagogical strategies that enable students to discuss these issues from a broader perspective regarding 'fitness for purpose'.

Chapter 19: Teaching Food Technology in a Secondary Technology Education Classroom: Exploring Ideas in Indigenous Contexts
This chapter will explore indigenous food types, design and processing, as cultural resources that can help in the teaching of food technology in technology education in South Africa. It is important to create awareness in secondary technology teachers, who may feel their teaching is under-resourced, about the enriching role that food technology can play in indigenous contexts. Food technology is mistakenly limited to the conventional versions of food only.

Chapter 20: Learning Cultural, Ecological and Food Literacies Through the Gumbaynggirr Pathway of Knowledge Project
This chapter presents research from a project collaboration undertaken in New South Wales, Australia, between a rural primary school, local Aboriginal Gumbaynggirr Elders and Southern Cross University. The aim was to understand food values at the core of Australian native food and plant knowledge systems, coupled with developing transferable teaching strategies for the classroom. Exploring and understanding natural food sources were triangulated between the Australian Aboriginal science and Western science, visualised through nature journaling.

Part I
Food Teaching in Primary and Secondary Schools in Different Cultures

Chapter 2
Exploring Food Education in the English Primary Curriculum

Sue Miles-Pearson

Abstract There have been a lot of changes over the years within the English primary education system, and this chapter investigates what impact this has had on design and technology (D&T) and in particular the food technology education element. I am going to reflect on previous research in 2009 on teaching food education with university initial teacher education (ITE) trainee teachers. I will then replicate this research to explore if, and how, the results have altered in 10 years and why this is significant to us in how we move food education forward.

For the second part of this chapter, I have contacted a spread of 25 primary schools across England to find out just what food education is being taught and how it varies throughout the age phases. I am going to be looking at the different primary age ranges, firstly early years (3–5 years old). This area will focus on nursery and reception classes and the early year's framework that they follow, concentrating on what skills are being both taught and learnt. Within Key Stage 1 (5–7 years old) and Key Stage 2 (7–11 years old), I will reflect on the content from the current national curriculum in England.

My expectation is that my research will enable myself, and others, to gain an overview and a better understanding of what changes have occurred during the last almost 10 years. The later part of this chapter considers food education currently being taught across England in early years and primary schools. Literacy and numeracy have a dominant focus in English primary schools, and I want to see if this has had an impact on the teaching of food education.

Keywords Food teaching · Primary schools · England · National curriculum Food technology · Cross-curricular

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The Primary National Curriculum

Food education, taught as cookery, was first introduced in the English schools in the nineteenth century. This later became home economics, which included textiles and covered not only learning how to cook but also how to clean and launder clothes, in secondary schools in 1985 (Her Majesty's Stationary Office, (HMSO), 1985). It was intended to help pupils prepare to be a good homemaker, which was aimed mainly for the girls. Similarly, craft, design and technology (CDT) (HMSO, 1987) aimed at helping pupils become more proficient with tools in woodwork, metalwork and generally building skills and was taught mostly to boys. However, the government realised the benefits of having all these specialisms (Department of Education and Science (DES), 1990), and by 1990 and the introduction of the national curriculum (DES), it was decided that all of these skilled subjects should be brought together under the umbrella term of design and technology, making it more of an inclusive subject for all pupils.

It was not long before secondary schools found that the pupils who were coming into Year 7 did not have the skills that they needed to embark in the D&T lessons and teachers needed to teach basic skills using simple 'focused practical tasks'. Skills such as how to thread a needle and sew a basic stitch within textiles; learning skills and techniques on how to saw, sand and join pieces of wood together. Within food technology learning simple cooking skills like, rolling, kneading, blending, creaming, whisking and cutting. All of which took up a lot of value lesson time. Thus, D&T was introduced into primary schools, so they could learn the basic life skills they needed before going to secondary school (British Nutrition Foundation (BNF), 2017). But has it been as embraced by the primary schools as we in the profession would have hoped? Unfortunately, it is not being taught as much as we would have liked, whether this is because of the class teachers lacking in confidence and personal skills to be able teach D&T or whether the strong emphasis on teaching the core areas of English and mathematics has had an impact, leaving very little time for the wider curricular subjects, or could it be that a lot of organisation and resources are needed? The Design and Technology Association founded in 1989 (Design and Technology Association, 2018) currently provides a bounty of resources to support educators teaching D&T to both primary and secondary schools.

In 2012 I was fortunate enough to be asked to be a part of the working party to revise the primary D&T programmes of study in the national curriculum for pupils aged 5–11 years (Department for Education (DfE), 2013). Unfortunately, the government appeared to want to take food technology out of D&T curriculum; but after a lot of lengthy discussions, the outcome was that, through a variety of creative and practical activities in D&T, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of relevant contexts and use a wide range of materials and components, including construction materials, textiles and *ingredients*, according to their characteristics (DfE, 2013, pp. 2–3).

However, it also introduced a new section called cooking and nutrition as part of their work with food which, as the title suggests, had a different focus to the previous 'food technology' component. It aimed to ensure that the pupils learn the 'principles of nutrition and healthy eating, including where food comes from and how to make some basic dishes' (DfE, 2013, p. 3). There is also a school of thought that children in their school should be encouraged to grow the vegetables that they use in the kitchen (Baker & Shelley, 2013). Nevertheless, the working party was not allowed to embed 'cooking and nutrition' within D&T; it had to be a stand-alone section at the end focusing on 'learning to cook'. The English national curriculum states:

> Instilling a love of cooking in pupils will also open a door to one of the great expressions of human creativity. Learning how to cook is a crucial life skill that enables pupils to feed themselves and others affordably and well, now and in later life (DfE, 2013, p. 4).

In the next section, recent research is discussed looking at comparative results from identical research carried out in 2009 (Rutland & Miles-Pearson, 2009). I anticipate that my current research (2018) will reflect as to whether the English primary national curriculum revision of 2013 has made a difference to our research results from almost 10 years ago and if in fact food lessons have changed: whether this is through what they are cooking or how they are approaching the subject or if there has been a change in the amount of food sessions that are being taught.

2009–2018: Potential Changes in the Position of Food in the Primary School Curriculum

In 2009 a research project 'The position of food in the school curriculum: implications of the Review of the Primary Curriculum in England' (Rutland & Miles-Pearson, 2009) was completed. Ten years on (2018), the research has been repeated to see if the views of the students and the primary schools have altered in respect to the importance of food in the primary curriculum. It focuses on what the ITE students had observed or taught in relation to food technology in the primary school. These students for both sets of research data were undergraduate students and postgraduate students in primary education at the University of Roehampton. In the original research 10 years ago, the total number of students that took part in the cohort was 650. Due to the climate change in teaching in England, there has been a host of different routes into the profession, and the overall number of ITE students has greatly reduced; evidence has shown at least 29% less applications for teacher training degrees over a 1-year period from 2017 to 2018 (Times Educational Supplement (TES), 2018). However, I decided to proceed with the research to see how attitudes have changed about teaching food in the primary school. The number of students that participated in the current research is 450.

The results from the research are set out below, each table referring to a different question. As with the original results (Rutland & Miles-Pearson, 2009), they have been organised in age ranges separating nursery and reception followed by each year group up to Year 6. Although we were looking at the national curriculum, early year's classes have been included, as we wanted to see if they were being prepared with the basic skills and knowledge that they would need for Year 1. I will use my current results to reflect on the previous tables and discuss my findings.

Question 1: 'Have you observed any food technology sessions being taught in your placement schools? What was the content of the sessions being taught?'

In Table 2.1 of the original research (Rutland & Miles-Pearson, 2009), Key Stage 1 (Years 1 and 2) activities show some progression in the skills and knowledge needed, although the main difference in the early years was the variety of things that the children were making, i.e. tortilla wraps and pancakes. In the current research (Table 2.2), we can see that there has been very little progression from the reception experience.

In Table 2.1 of the original research (Rutland & Miles-Pearson, 2009), Key Stage 2 (Years 3, 4, 5 and 6) activities show that there was not actually much of a progression in the variety of food that was being cooked, although there seemed to be more opportunity to develop the skills and knowledge from prior learning when the children were in upper Key Stage 2 (Years 5 and 6). Reflecting on the information within the current research (Table 2.2), we can see that there is not much of a selection of food being taught, the focus that is being taught has a strong link to other curriculum subjects, for instance, looking at instructional writing in literacy, weighing and measuring for mathematics and reversible and irreversible change in science; and themes from history looking at food in other countries, although they have started to look at how food is grown in Year 5. Comparing the results of Tables 2.1 and 2.2, there seems to be a distinct diminishment of the amount of food being taught in the primary classroom, with a lot of repetition in the skills being taught.

Question 2: 'Have you taught any food technology sessions in your placement schools? What was the content of the sessions being taught?'

In Table 2.3 for the previous research (Rutland & Miles-Pearson, 2009), we looked at what was being taught in the different age phases. Interestingly, in the previous research the students had taught a wide range of cooking in nursery, compared to just sandwiches being taught in reception. However, when we observe these phases in Table 2.3, we can see that there is a lot more of an even spread of cooking being reported and skills and knowledge being taught. The British Nutrition Foundation (BNF, 2019) states as part of their 'food teaching in schools' that the framework of knowledge being taught should include the 'teaching of food preparation and cooking' and 'promoting and applying nutrition'. This does nevertheless refer to children from the ages of 5–16 years old, with no mention of early year's education.

In Table 2.3, Key Stage 1 (Years 1 and 2) in the previous research (Rutland & Miles-Pearson, 2009), there was a range of recipes and skills being taught across the 4-year groups. However, when you look at Table 2.4 for the current research, you can see that only a gingerbread recipe was taught in Years 3 and 4 and then in Year

Table 2.1 Previous research (Rutland & Miles-Pearson, 2009)

Question 1 Food technology sessions observed

	Nursery	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Products	Pizza Fruit salad Gingerbread men Bread Flapjacks Smoothies Chinese new year Cakes Porridge Chocolate nests Rock cakes Cookies (stained glass) Easter nest cakes Noodles Cornflake cakes Mini eggs Mini Xmas cakes Sandwiches Biscuits Bird food	Pumpkin soup Fudge Xmas biscuits Valentine biscuits Bread Biscuits Xmas cake Gingerbread men Pancakes	Sandwiches Cakes for Chinese new year Fruit salad Chocolate Easter Cakes Porridge Pancakes Topping for Pancakes Tortilla wraps Biscuits Peppermint creams—Xmas Healthy pizza Xmas cornflake/ chocolate cakes	Kitten cakes Pizza Bread Sushi Easter baking Fruit skewers Salad Cakes Icing biscuits Pancakes Planet pizza Iced cakes Kipper cakes (story)	Apple pies Brownies Apple pies Sandwiches Muffins Xmas cookies Pancakes Burgers Fruit salad Wraps Fillings Fruit kebabs Gingerbread men	Boston Cookies Banana bread	Bread Brownies Xmas cakes Design and make biscuits Smoothies—experiment Scrambled eggs (science) Buddle and squeak (history)	Brownies Pancakes Pizza—Xmas fare Shortbread

(continued)

Table 2.1 (continued)

Question 1 Food technology sessions observed								
	Nursery	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Skills	Setting in fridge Baking Follow instructions Melting chocolate Measuring (maths) Tasting	Cooking Cutting, weighing		Following instructions Writing instructions	Following a recipe Working together Cutting Measuring Designing icing	Working together Cutting Measuring Designing icing Following instructions	Writing instructions Working together	Working together Weighing ingredients
Knowledge	Hygiene Healthy eating Science through D&T (liquids/ solids) Space theme Easter	Diwali—linked to art	Healthy eating Links to previous work on fruits Aztecs	Healthy eating Shrove Tuesday Links to literacy	Shrove Tuesday Healthy schools Healthy eating Changing ingredients	Combining ingredients Effect of heat Healthy sandwiches Tasting Hermitage week Balanced diet	Links to literacy Science (yeast) Healthy eating Links with PHSE and science Irreversible changes Foods from the garden	Links with maths (shortbread)

Table 2.2 Current research (2018)

Question 1 Food technology sessions observed

	Nursery	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Products	Bread Gingerbread—decorating Cheese-straws	Bread Porridge Rice crispy cakes Cupcakes Pumpkin soup Pumpkin pie Vegetable—stir fry Scrambled eggs	Fruit—smoothies Jam-sandwiches Vegetable—soup Cupcakes Biscuits Fruit salad Gingerbread	Icing biscuits Pitta pizza Bread Cookies Porridge Cheese—sticks	Ratatouille Cheese-biscuits Vegetable kebabs Rock cakes Sandwiches	Egyptian sweet-making Bread rolls Mushroom—soup Ratatouille Rice crispy cakes	Bread Christmas cakes	Fruit kebab Sandwiches Date and oat bars
Skills	Kneading Rolling Baking Grating Cutting Follow instructions Measuring (maths) Smelling Tasting	Kneading Rolling Baking Melting Cooking Cutting, weighing	Cutting Blending Creaming Spreading Following instructions	Kneading Rolling Baking Grating Decorating Following instructions Writing instructions	Cutting Measuring Creaming Blending Following a recipe Working together	Kneading Shaping Cutting Measuring Creaming Blending Following a recipe Working together	Kneading Weighing Measuring Writing instructions Working together	Working together Weighing ingredients

(continued)

Table 2.2 (continued)

Question 1 Food technology sessions observed								
	Nursery	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Knowledge	Hygiene Healthy eating Science through D&T	D&T linked through literacy and stories Also looking Basic reversible and irreversible change Safety using cutting tools	Safety in the kitchen Links to literacy with storytelling Maths knowledge/ measuring/ weighing	Science—changing state Effects of yeast Maths knowledge/ measuring/ weighing	History links to Second World War Healthy eating Changing ingredients Maths knowledge/ measuring/ weighing	Combining ingredients Science—effects of heat Geography/ history Egyptian sweets	Links to literacy Science (yeast) Healthy eating Links with PHSE and science Irreversible changes Foods from the garden	Health and safety Maths knowledge measuring/ weighing Link with RE Jewish celebration

Table 2.3 Previous research (Rutland & Miles-Pearson, 2009)

Question 2 Food technology sessions taught by ITE students

	Nursery	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Products	Snacks Chocolate sparklers Fruit salad (Oliver's fruit salad) Porridge Fruit skewers Salads Cakes Chinese New Year cakes Pancakes Angel cake Popcorn Biscuits Gingerbread men	Sandwiches	Fruit salad Biscuits Cakes Pizza	Brownies Planet pizza (space project) Sandwiches	Healthy sandwiches Tortilla wraps—Aztecs	Roman feast grapes, honey bread School trip—packed lunch—sausage, soup	Bread	Biscuits Scrambled eggs—science Bubble and squeak
Skills	Experimentation Describe and taste Making shapes—marzipan Making shapes—marzipan Golden time activity Handling foods Making decisions		Follow instructions Practical skills Making shapes—marzipan Using equipment safely	Practical Writing instructions	Follow instructions Copy skills	Designing of foods Being creative		Designing for purpose Appearance Experimentation Making food from basic ingredients

(continued)

Table 2.3 (continued)

Question 2 Food technology sessions taught by ITE students								
	Nursery	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Knowledge	Good growing foods Properties of foods Healthy foods Properties of foods—porridge Different cultures Healthy choices Measuring—numeracy Consistency What happens in the oven Changing ingredients—science Indian foods		Health and safety	Links with literacy		Likes/dislikes Foods available in Roman times Rabbit, goat, vegetables Changing ingredients/flavours	Hygiene Purpose of ingredients	Links with science, e.g. irreversible change Links with history, e.g. rationing and growing food in the garden

Table 2.4 Current research (2018)

Question 2 Food technology sessions taught by ITE students

	Nursery	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Products	Christmas decorations	Pumpkin soup Pumpkin pie	Vegetable-soup Gingerbread Healthy snacks Sandwiches	Bread	Gingerbread	Gingerbread	Evaluating different types of bread	Date and oat bars
Skills	Rolling Baking Use shaped cutters Follow instructions Measuring (maths) Smelling Tasting (science)	Healthy eating Following instructions (English) Cooking Cutting, weighing (maths)	Cutting practice Decorating H&S Blending Following instructions (English)	Following instructions Reflecting on method (English)	Cutting Measuring (maths) Creaming (PSHE) Following a recipe Working together	Following a recipe (English) Working together (PSHE) Weighing Measuring (Maths)	Taste testing Comparing/ contrast (science)	Weighing ingredients Blending H&S Allergies
Knowledge	Hygiene Science and maths through D&T	D&T and maths linked through literacy and stories	Links to literacy with storytelling Maths knowledge/ measuring/ weighing	Science—changing state Effects of yeast Maths knowledge/ measuring/ weighing	D&T and maths knowledge/ measuring/ weighing	Combining ingredients Science—effects of heat	Links with geography breads from around the world	Health and safety Maths knowledge measuring Link with RE Jewish celebration

6 a date and oat recipe. In Year 5, they did not do any cooking, just a taste-testing and an evaluation of a variety of different breads from around the world. Although no cooking was done, this was a good way to develop their scientific knowledge of comparing and contrasting and of their geographical knowledge of where their breads had come from.

Question 3: ‘What do you think that children in primary school should learn about food?’

Table 2.5 Previous research (Rutland & Miles-Pearson, 2009)

Question 3a What do you think that children in primary school should learn about food?					
Knowledge	Number of responses	% of responses	Skills	Number of responses	% of responses
A balanced diet	14	6.39	Being creative	2	2.99
Costing	1	0.46	Basic cooking skills, measuring and making	20	29.85
Ethics of food	1	0.46	Experimenting and combining ingredients	7	10.45
Food groups and nutrition	14	6.39	How to cook simple products/meals—toast, pizza, desserts, bread, salads, pizza 10	21	31.34
Foods from other cultures	7	3.20	How to cook healthy meals	9	
Food miles—sustainability	1	0.46	How to follow instructions	1	1.49
Food science	1	0.46	Evaluating and modifying	1	1.49
Greater understanding of their bodies	3	1.37	Safety with utensils	5	7.46
Healthy foods/eating	107	48.86	Tasting foods—sensory evaluation	1	1.49
Healthy lifestyles	3	1.37			
Health and safety of foods	23	10.50			
Health risks	1	0.46			
Hygiene	9	4.11			
Properties of foods	4	1.83			
Storage of food	2	0.91			
Where food comes from	12	5.48			
What foods are made of	6	2.74			
Total number of responses	219	100	Total number of responses	67	100

Table 2.6 Current research (2018)

Knowledge	Number of responses	% of responses	Skills	Number of responses	% of responses
Healthy eating/ balanced diet	42	57.53	How to cook simple meals, i.e. pizza, toast bread, salads, etc.	16	44.44
Cutting skills	6	8.22	How to follow simple instructions	10	27.78
Where food comes from	5	6.85	Basic cooking skills—measuring and making	8	22.22
Life skills	5	6.85	Safety with utensils	1	2.78
Health and safety using kitchen equipment	3	4.11	Being creative	1	2.78
Basic savoury recipes	3	4.11			
Being creative with food	2	2.74			
Allergies/health risks	2	2.74			
How cooking can taste good	2	2.74			
How to make scrambled eggs	2	2.74			
Forest school—leaf kebabs	1	1.37			
Total	73	100.00		36	100.00

This question has been broken up into skills and knowledge in Tables 2.5 and 2.6. Comparing the previous and current research (Rutland & Miles-Pearson, 2009). The percentage of ITE students thought that ‘healthy eating’ and a ‘balanced diet’ was 55.25% compared to 57.53% in the current research (Table 2.6). I did expect an increase with all the recent articles on healthy schools (Harris, 2013; Lannelli, 2018; NHS, 2018; Oliver, 2017; Owen, 2013), especially with the rising concerns of childhood obesity (Freemark, 2018; Gatenby, 2010; Gesserick, Vogel, Gausche, et al., 2018; Gov.uk, 2019; Oliver, 2017). However, with only a rise of just under 2% I found this quite staggering, as with all the publicity around this area I thought that this would have been a greater increase. Reflecting on this area of healthy eating, I looked at another area ‘How to cook a simple meal’; this had 31.34% of ITE students in the original research (Rutland & Miles-Pearson, 2009) believing that children should know these basic skills. This compared to 44.44% in the current research which is an increase of 13.10% overall. Another aspect that was believed should be covered was that pupils should learn ‘basic cooking skills, including measuring and making’. This was stated by 29.85% of ITE students in the initial research (Table 2.5) compared to 22.22% in the current research (Table 2.6), which is a drop of 7.63% over the last 10 years. Is this a true reflection of how society are relying more on pre-prepared food rather than cooking everything from scratch?

We can also see (Table 2.6), current research, that the students have come up with suggestions that were not present on the previous research. For instance, they have said that children should learn more about allergies and forest school food (cooking outdoors, directly from nature), although to my surprise they have not considered the carbon footprint and the food miles and sustainability that had previously been mentioned (Rutland & Miles-Pearson, 2009). I will address Question 3, when I look at the different curriculum areas that the ITE students thought that food should be taught in.

Question 4: In which curriculum areas do you think they should learn about food?

In Tables 2.7 and 2.8, the ITE students were asked 'what curriculum area do you think that food should be taught in'? The results showed that science is a strong leader as a preferred subject in the recent research to teach food with 19.47% (Table 2.8); this compares to 27.73% (Table 2.7) in the previous ITE student research (Rutland & Miles-Pearson, 2009), which, although agreeing with science being the forerunner, was a hefty decrease of 8.26%. Although all the curriculum areas were represented, the other main surprise was that the amount of ITE students that suggested that food should be taught in a cross-curricular setting has decreased from a massive 24.35% (Table 2.7) in the previous research (Rutland & Miles-Pearson, 2009)

Table 2.7 Previous research (Rutland & Miles-Pearson, 2009)

Question 4 In which curriculum area do you (ITE student) think children should learn about food?		
	Responses	% of responses
Art	6	2.95
D&T	58	18.83
English	4	1.30
Geography	16	5.19
History	11	3.57
ICT	1	0.32
MFL	2	0.65
Maths—measuring	10	3.25
PE	13	4.22
PHSE	20	6.50
RE	14	4.55
Science	70	27.73
Literacy	5	1.62
Numeracy	1	0.32
Citizenship	1	0.32
Creative curriculum	1	0.32
Cross-curricular	75	24.35
Total	308	

Table 2.8 Current research (2018)

Subject/area	Responses	% Responses
Science	37	19.47
Geography	24	12.63
D&T	21	11.05
English	20	10.53
History	19	10.00
Maths	16	8.42
Art	14	7.37
PE	13	6.84
PSHE	13	6.84
RE	7	3.68
Cross-curricular	6	3.16
Total	190	99.99

10 years ago to a modest 3.16% which can be seen in Table 2.8, meaning that there has been a substantial drop of 21.19%. I would like to investigate this further in the future with alumni students, to see if their views have changed.

Question 5: What content of the food technology sessions that you attended at the university were most useful and what else would you include?

Looking at Table 2.9, there are clear comparisons between the two pieces of research that have been carried out over a 10-year period. In the most recent research, we can see that there is some consideration about sustainability and the amount of food that is wasted. Health, safety and food waste have a greater emphasis; although we can see that since the change with the food element in the current D&T national curriculum (DfE, 2013), where the food aspect is now referred to as 'cooking and nutrition', there is a lot less importance given to looking at the effect of changes in ingredients. However, we can see from looking at the table that taste testing has been given more inference. This is quite possible since there is uncertainty and lack of clarity as to whether the scientific enquiry element has been removed from primary national curriculum (DfE, 2013).

Discussion

When reflecting on the past research recommendations, Rutland and Miles-Pearson (2009) examined the teaching of food and how it is seen in the primary curriculum through the views of ITE students. We can see that there was a strong belief that teaching food to primary school children would benefit from a strong association with science due to the commonality of the foci involved, for example, looking at the properties of ingredients and how they are used. As we can see in Tables 2.1 and 2.2,

Table 2.9 Previous research (Rutland & Miles-Pearson, 2009) and current research (2018)

Question 5: Content of university food technology session		
Previous research 2009		Current research 2018
1	Analysing	7
4	Being creative with ingredients	4
19	Effect of changing ingredients	
12	Exploring/experimentation	10
4	Health and safety	27
2	Organisation of lessons	24
3	Simple cooking skills	15
16	Tasting foods	33
5	Varying ingredients—toppings/fats/flours/liquids	35
	Extras to include	
2	Deserts	
1	Budgeting	
4	Cakes	4
1	Cooking healthy snacks	8
1	Cultural food	3
1	Fruit salads	
7	Healthy eating/diet	13
1	Packaging	4
	Methods of cooking/building confidence to teach	9
1	Pancakes	
1	Pies	
2	More food technology time	1
1	Nutrition	8
1	Risk assessment	
1	Scones	
	More recipe ideas for the classroom	9
	Using leftovers	1
	Sustainability	1

the ITE students now believe there should be a stronger emphasis of teaching food across a wider range of the curriculum disciplines, which is in agreement with Rose where he stated:

> Food is a very large and important area of knowledge and learning for children. Locating it in one subject or area is unwise (Rose, 2009).

This, however, does not reflect what was observed in the primary classrooms. In comparison, the teacher's views will be discussed within the findings and conclusion of this chapter. Interestingly, only one ITE student in the current research had really considered sustainability and the carbon footprint, when they were asked what they thought children should be taught in the food lessons.

When looking at Table 2.3 (Rutland & Miles-Pearson, 2009), comparing it to the current research (Table 2.4), there definitely seems to have been a shift towards less food being taught in nursery. I have come to the conclusion that this may well be because of a lack of confidence on the teacher's behalf, as there are elements of health and safety that would be addressed when teaching food skills to children, and as very young children can be very unpredictable, this can be quite challenging. Nevertheless, this is a concern as the children in Year 1 (5 years old) need to build on their prior learning experiences from the early year's foundation stage (Rose, 2009), and without this sound foundation, the children are disadvantaged. We can also see a decline again in Table 2.4 in the teaching of food in upper Key Stage 2. This could be partly due to the changes in the 2013 English primary design and technology national curriculum (National Curriculum 2013). There is also the possibility that this could be partly due to newly qualified primary teachers, who have chosen to train on a different new 'school-based' route into teaching in the United Kingdom (UK). As a result, they may not necessarily have benefitted from the D&T sessions run at ITE providers that focus on key skills that teachers will need to teach a safe food lesson.

Interview Research from a Sample of Primary Schools Across England on What Food Is Taught in Their Schools

The next part of this chapter will give an overview of the interview answers relating to 'What food is being taught in their school?' Also, how often it is taught and who teaches it? Out of the 85 primary schools across England that I contacted, only 25 of them—21.25%—agreed to a short telephone interview about the teaching of food in their schools. I am concerned that having only 25 responses might mean that the majority of the other schools do not teach food. When interviewing the head teachers/coordinators, they addressed each age phase in the school, as had been done in the previous questionnaires.

The first interview question that I asked was: How often is 'food technology' taught in your primary school?

Findings:

- In the early years—nursery and reception. There seemed to be a regular pattern of daily/weekly food being taught, where children were encouraged to develop basic skills and hand eye coordination. I will explore this more when we look at the other questions.
- In Key Stage 1—Years 1 and 2. It varied from two to three sessions a term to only once a term.
- In Key stage 2—Years 3, 4, 5 and 6. This was a lot more varied where the teaching of food ranged from every 3 weeks to termly or even annually.

'Cornerstones' (Cornerstones Education Ltd. 2018) is a scheme of work that quite a lot of schools seemed to be following, so I am going to investigate this further at a later date.

The second interview question that I asked was: 'Who teaches "food technology" in your primary school?'

Findings
This was a quite a standard answer across all the schools, with the class teacher teaching the food sessions with the teaching assistants helping. In a few schools, parents came in to assist the teacher when a teaching assistant was not available.

The third interview question that I asked was: What sort of things do the children cook?

Findings
In the Early Years Foundation Stage (EYFS) within the UK, (including any Ofsted registered EYFS providers), have a compulsory set of skills, knowledge and understanding that have to be taught to the children aged 0–5 years old. These are known as the seven areas of learning and development (Mohammed, 2018). These are divided into three prime areas (physical, communication and personal, social and emotional) and four specific areas (literacy, mathematics, understanding the world and expressive arts and design). Many of the food activities would probably be linked to the specific areas that involve key life skills the children will need (Pascal & Bertram, 2017). It seems that the 'Froebelian' influences of early years of teaching and learning have not been totally lost (Tovey, 2017).

In the older age phases, I was pleasantly surprised at the extensive range and variety of foods that the children were cooking. In some cases, even planning a meal, cooking and serving parents and families the meal also included an evaluation of how things had gone. There was also lot more schools that were growing their own fruit and vegetables. There was a lot of topic-based and cross-curricular food being taught; some of these were from the 'Cornerstones' schemes of work which I mentioned earlier (Table 2.10).

The fourth interview question that I asked was: 'Is food technology taught in any extracurricular sessions, i.e. after school club?'

Findings
- In Nursery, Reception and Year 1, there were no extracurricular sessions. This is understandable as the day is long enough for the younger children.
- In Year 2 there were various things going on related to food. They were given 'homework' where they had to plan a three-course menu (this was after a lot of input in the classroom), and there were lunchtime food clubs. In some schools, they were growing their own fruits and vegetables.
- In Year 3 there tended to be an after-school cooking club (which was facilitated by a teaching assistant).
- In Year 4 there was a 'bikers' breakfast for children who cycle to school.

Table 2.10 What sort of things do the children cook?

	What sort of thing do the children cook?
Nursery	Biscuits—linked to topic/drying fruit/soup/gingerbread men (key skills)
Reception	Learning basic skills rolling/kneading/soup
Year 1	Afternoon tea—sandwiches (no designing)/fruit kebabs/taste testing/fruit smoothies/salads/chopping and cutting skills/gingerbread men/eating the rainbow/taste testing/pumpkin soup
Year 2	Taste testing and sensory analysis/fruits from around the world/cakes/pizzas/flapjacks/fruit smoothies/salads/chopping and cutting skills/bread (great fire of London)/fruity yogurt cups
Year 3	Smoothies/children cook their own lunch/make their own ice cream (links with an ice cream producer)/growing own food/plan and cook a two-course meal/sweet potato and chickpea curry
Year 4	Taste testing cheese/growing own food/Romans salad/plan and cook a two-course meal/Spanish omelette/tasty tomato pasta
Year 5	Bread (around the world)/growing own food/South American food/Aubergine dips
Year 6	Christmas dinner/café–serve parents and families/growing own food
	Always—design/make/evaluate—for a purpose

- In Year 5 there was a 'hook cook' residential experience (cooking Victorian food) making Victorian cakes.
- In Year 6 the children hosted a community Christmas party for the elderly—where they planned, prepared, cooked and served. There were also a few schools that focused on First World War food, and after researching, they went on to make it.

Holding a community Christmas party for the elderly was an amazing idea, which covered a whole range of skills. This could be also adapted for other events throughout the year. The quantity of cross-curricular opportunities that are going on in schools is remarkable.

The fifth and final interview question that I asked was: 'What cross-curricular opportunities do you link to your food sessions?'

Looking at Table 2.11, there seems to be quite a range of different cross-curricular activities in the schools. One thing that seems to occur in various guises is teaching the children about where food comes from and how it has been grown. There are different organisations available to support schools in teaching food in the primary classroom. The British Nutrition Foundation (BNF, 2019) runs a website called 'Food a Fact of Life' which has a host of ideas for teachers, including activities and videos for children, to help them understand the basics of teaching food in the classroom. Another website is 'School Food Matters' (2007) which has a host of ideas on their site. In fact, Ofsted launched a new inspection framework in 'School Food Matters' in January 2019 stating that nursery and reception are learning a lot of new life skills that will prepare them for their school life. The new inspection framework (Ofsted, 2019) states that 'instead of feeling able to spend time reading to children, or playing with them, nursery staff feel pressured into

Table 2.11 ‘What cross-curricular opportunities do you link to your food sessions?

	What cross-curricular opportunities do you link to your food sessions?
Design and technology	Healthy eating/risk assessments/progression of cooking skills/links with local butcher for children to design a sausage
Literacy	Adjectives for sensory activities/writing instructions/key vocabulary/goldilocks and the three bears
Mathematics	Weighing/measuring ingredients/goldilocks and the three bears/breakfast tally charts
Science	Food and nutrition/healthy eating/drying fruit/independent research project on honey/goldilocks and the three bears
Physical education	Healthy eating
Geography	Where food is from/recipes from different countries/field to plate
History	Children to research Roman food and design a menu/history of breakfast around the world/First World War food/Victorian cakes
Art	Still life
Computing	Child set up his own ‘food blog’ about growing his own vegetables
PSHE	Healthy eating/well-being/staying safe and physically healthy
Religious education	Festivals/Chinese New Year/celebration with food

completing endless documentation to demonstrate each stage of a child’s development’. Baselines are important but the Government do not realise how much learning goes on whilst the children are learning new skills, playing and using their imagination.

Conclusion

Having reflected on my research, I have found that over the last 10 years there have been some significant changes to the food sessions that are being taught in the primary schools across England. Firstly, I would like to help build the confidence of teachers who are not D&T specialists, encouraging schools to hold twilight sessions, or arrange cover for their staff to attend a D&T skills booster course. At the very least, ensure that the schools have membership to the Design and Technology Association so that as they will have their support.

From the interviews, I have found out that there are a lot of amazing initiatives that we need to make sure are known about in schools. I would be very interested to see if the pupil’s academic progress has benefited from these practical activities, as they often help promote an emotional well-being as well as a healthier body for the pupils (Wheatcroft & Woolley, 2018).

This has informed and updated my own understanding, which has in turn given me a focus on how to move forward with my own ITE training at the University in the future, making sure that all the future primary school teachers that I teach are fully versed in what is going on in schools and how they can empower the pupils’ own learning of food technology. I hope that they can encourage some of their fellow teachers to look more at the possibilities of cross-curricular opportunities in the English primary classroom.

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Chapter 3
Reducing Challenging Behaviour and Maintaining Aboriginal and Torres Strait Islander (ATSI) and Non-ATSI Student Retention Through Food and Exercise in Primary and Secondary Schools in New South Wales, Australia

Gillian Stuart and Angela Turner

Abstract This chapter reflects on research projects and initiatives undertaken during my 40-year career as a classroom teacher, head teacher, regional educational consultant, teaching principal and principal. The work discussed in this chapter evolved through postgraduate research, in-school funded and unfunded projects and initiatives. Our combined analysis elicits an examination on pedagogy and the unique learning outcomes that emerged from these settings. The theoretical grounding for much of this work draws Maslow's hierarchy of needs. More recently we present our joint research collaborations undertaken through cross-cultural and multidisciplinary teaching and learning contexts. This chapter emphasises that enriched learning environments supported through physical activities and food applications are by far the most salient influences to improve intellectual learning outcomes, physical dexterity, emotional strength and resilience in students.

Keywords Health-based education programs · Food · Exercise

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Introduction

My teaching passion is positioned in place-based learning experiences as a way to connect communities, with the goal to increase student engagement through authentic and meaningful project-based programs for students of all ages and backgrounds to improve student learning outcomes. Over the past 40 years, these have ranged from external initiatives run in the school such as the Live Life Well @ School program, Crunch and Sip®, Fruit & Veg Month, Nutrition Week and Walk to School Day. Funded research projects include The Coffee Den, Aboriginal and Torres Strait Islander (ATSI) and non-ATSI community engagement (Reaching On Reaching In) and understanding changing climates and food sustainability through science, technology, engineering and mathematics applications (STEM in the Garden). In addition, opportunities were offered as vocational experiences to technical and further education (TAFE) students in relation to building a Bush Tucker Track and associated learning spaces in the school that opened up an innovative avenue for 'outdoor' learning spaces.

The primary driving force of my teaching is positioned from my own life experience with developmental challenges in childhood, with difficulty sitting still and unable to organise my thoughts to express myself on paper. I was placed in remedial groups for mathematics and English, with trouble focusing on reading and great difficulty with comprehension *but* I was excellent in sport, oral expression and all the creative arts. As I grew up, it fascinated me that I could be at the top of the class in some subjects and in those that would influence 'where I would end up', at the lower end of the class. It was a time of great frustration and, in spite of this, eventually trained me as a teacher wanting to help people who had learning difficulties similar to me. After two attempts at the high school certificate, I progressed to Teachers' College, majoring in physical education, graduating with a Diploma in Teaching (Primary Education) in 1982.

However, after 2 years in the classroom and encountering lots of children who had similar learning difficulties as me, I became overwhelmingly disheartened because I could not make a significant difference for these students. I left teaching to travel the world. It was during this period I was exposed to applied kinesiology in Los Angeles in 1986, and when on return 3 years later, I attended a weekend workshop on *Educational Kinesiology 'E- K for kids'* which reignited my interest in helping children and young people who had learning difficulties. This inspired me to train further in educational kinesiology (Brain Gym®) to instructor level. Brain Gym® is a series of specific movements that activate the brain and body for particular skills of behaviour management and learning, i.e. focus (action), organisation (feeling) and communication (thinking). The program improves the physical skills, rather than focusing on just the mental skills involved in behaviour and learning (Dennison, 2006). Moreover, I completed a Masters (postgraduate degree) in Special Education: *Reducing Challenging behaviours in 'at-risk' Adolescents* in 2011 where I drew on kinesiology principles as the theoretical framing for the research component. At the time, research suggested that a high proportion of adolescents 'at risk' cannot execute the task of cross crawling. Experts reported that an inability to cross crawl indicates a neurological dysfunction which limits the workings of the brain in undertaking basic learning tasks which could underpin learning difficulties and behaviour problems. Goodheart (1970), in his research from applied kinesiology, discovered a type of patterning he called 'homolateral' (same side arm and leg), where people were unable to cross pattern—in other words, had an inability to cross the midline of the body. Goodheart associated this with schizophrenia as 'every' person with this diagnosis had a homolateral pattern.

Needless to say, cross crawl was a major exercise implemented in the Brain Gym Program throughout the research, as out of the 145 adolescents, only 17 could successfully manage to cross their midline on enrolment.

Teaching Philosophy

I have a firm belief that before learning can occur in a classroom, students need to have their basic needs met first. Like a seed that has the potential to grow through water and warmth that stimulate growth, a child has the potential for growth through food, water, warmth and love. Once these physiological needs are met, safety needs such as security and safety provide a fertile ground for personal development and learning. Maslow (1968, 1972) furthers that a child's need to 'belong' should initially be fulfilled through family, which in turn relates to self-esteem, and as a child grows, they ought to strive towards intellectual and spiritual growth (self-actualisation). However, schools in particular need to maximise a student's feeling of self-worth where a child may struggle to have these needs met in their home life (Fig. 3.1).

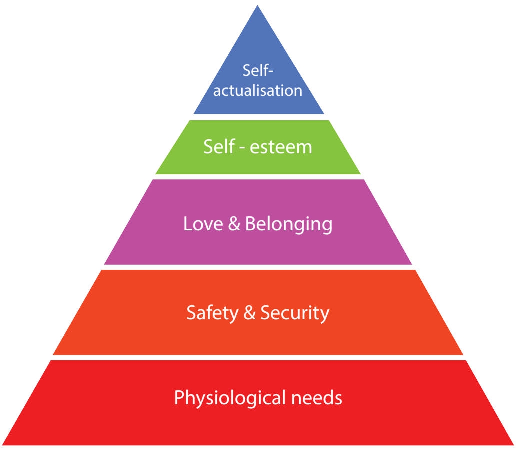

Fig. 3.1 Maslow's motivational theory as a hierarchy of needs

Therefore, my teaching philosophy bases itself on Maslow's hierarchy of needs with the purpose of promoting health-based education programs that engage food and exercise as a social currency for improving student learning outcomes.

Research Projects and Initiatives

Move to Learn Program (1999–2003)

During 1999, I designed my first *Move to Learn* sensory motor program. This was implemented at a local NSW government school one day a week for one term. The school community was so impressed with the results in terms of children's achievements across the curriculum; it opened up the opportunity to work in other government schools. A report on the progress of the program has been well documented and some 5000 children across 24 schools participated in the program over a 5-year period. As a result, many principals were strong advocates of the program's effectiveness as is shown in the following excerpts from their testimonials:

> Our students come to school happy, keen to learn, and able to reach their full potential. Through Edu-K, students have learnt ways to switch themselves on to learning, to assess their own performance as well as to enhance their learning style. All this makes for a happy, productive learning environment.
>
> The difference in attitude and improvement in the children's behaviour is easily measured by the lack of entries in the behaviour book and my comparison between long-term students and new arrivals.
>
> The program has been of particular benefit to the boys, in that it has really improved their participation and listening skills.

In 2003, results indicated that student engagement and achievement had improved significantly across a number of schools. It was reported by one school that classroom behavioural incidents had reduced from 60% to 5%. In 2004, ATSI data in another school indicated 88% K-2 students evidenced above the minimum standard, while 80% Years 3–6 students were grade appropriate:

> Gillian delivered quality education through in-school training to staff and students by designing the innovative sensory/motor coordination program called 'Move to Learn', which was implemented across 35 schools over a five-year period. Gillian was recognised internationally as a recipient of the 'Teaching through Movement' Award in England in 2002, for facilitating professional growth in teachers and offering motor coordination solutions to enhance student outcomes in learning and behaviour. A number of schools received special awards and grants from the Department Education of Training (DET) for their improved numeracy and literacy outcomes, and all principals advocated that the program was a contributing factor to their success.
>
> (Community Elder)

The Adolescent Centre, Brain Gym and the Coffee Den (2004–2010)

I relocated in 2004 from rural NSW to western Sydney where I was a teacher at an adolescent centre. This was a Department of Education specialist tutorial centre for Year 7–Year 10 students who demonstrated clinically diagnosed extremes in behaviour and learning-impeded disorders that ranged from emotional disturbance (ED), behaviour disorder (BD), ED/BD, oppositional defiant disorder (ODD), autism spectrum disorder (ASD) to attention deficit hyperactivity disorder (ADHD). At the centre there were three classes with seven students in each class. There was a mix of indigenous and non-indigenous students, although a higher proportion of indigenous students. However, the one thing that all had in common was that they were from low socio-economic backgrounds, and for many, family members are in jail.

All presented with mental health diagnoses at varying levels and all deemed unmanageable in the mainstream high school system. Students attending this school presented with extremes in life experiences: victims of emotional, physical and sexual abuse or were experiencing symptoms of psychosis. Major depression to post-traumatic stress disorder was also a diagnosed condition. Many students had co-morbid conditions**.** Suspensions were common due to aggressive behaviour towards teaching staff and/or between students. A few quick rules given to me were to (1) never be by myself, (2) always have my face to the students, (3) check for radio contact, (4) never disclose any personal information (no first name or surname), so I was known as ‘Ms. G’. The brief rundown on each student’s profile that was provided to me when I started was staggering given the age of the students: arson, sex offender, self-harm, drug dealing, addict, vandalism, theft and assault including stabbings. To say classroom management was a challenge is indeed an understatement.

Not long after starting at the centre as a casual teacher, an event that happened 1 day when I was playing rugby with the boys revealed there was a caring nature and respect that these boys held within. Unfortunately, this was discovered when I ran into the goal post and knocked myself unconscious. Regaining consciousness, in a blinking haze, there were flickers of light stream through a ring of very concerned humans, looking down like angelic beings. *Are you Ok Miss*? *Wanna hand*? Picking Ms. G. up gently, the so called youth-at-risk criminals, kindly and with great care, helped me back to my office. The topic and laughter for the rest of the day was Ms. G. and the footy game. One boy asked as he was leaving, ‘Are you coming back tomorrow Miss?’ Nonetheless, day after day, attendance was poor, and there was no interest or change in any of the students’ behaviour in the classroom. Clearly, they were not excited about learning skills in English or geography, but there was an opportunity to utilise the Life Skills component of the syllabus as a way to engage students in English and geography. I just wasn’t sure how.

Midway while working at the centre, I commenced postgraduate study. My interest was to examine the effects of an exercise program called Brain Gym® on the frequency of challenging behaviours in adolescents and to investigate to what extent changes in social relations resulted a change in the school community, as a function of the exercise intervention. The research project component drew on an action research approach. Ten Year 8–10 students from the centre were involved in the research. The investigation employed surveys, exercise interventions, baseline data and professional development, linking case studies in an action research design. Although much more extensive research was recommended with regard to the benefits of *Brain Gym*®, the findings revealed that consistent daily practice of Brain Gym® improved students' self-esteem and well-being that flowed onto their social-psychological health. The results showed a reduction in challenging behaviours and assisted students to achieve better learning results. Figure 3.2 shows a significant decrease in the frequency on off-task behaviour when exercise was embedded into the teaching program. However, there was a significant rise post-test on off-task behaviour for student 1 and student 2 (post-test). This may have been due to a change in routine for these students given they were ASD students. Nonetheless, there was a decrease in off-task behaviour for eight students out the ten observed.

During this period, I noticed students did not appear to bring lunch to school and I often wondered if they ate breakfast (given very few students had families to rely on as their safety net), so I initiated a cooking class where specific recipes were chosen, which required limited cutting with plastic knives and minimal cooking equipment, due to the work, health and safety policies. I began using food as an incentive for the students to come to school to eat rather than stay at home where empty fridges and cupboards prevailed. This dramatically impacted on student outcomes on attendance and in both short and long suspensions. As one student commented in 2006, 'Before you came, Miss G not much happened'.

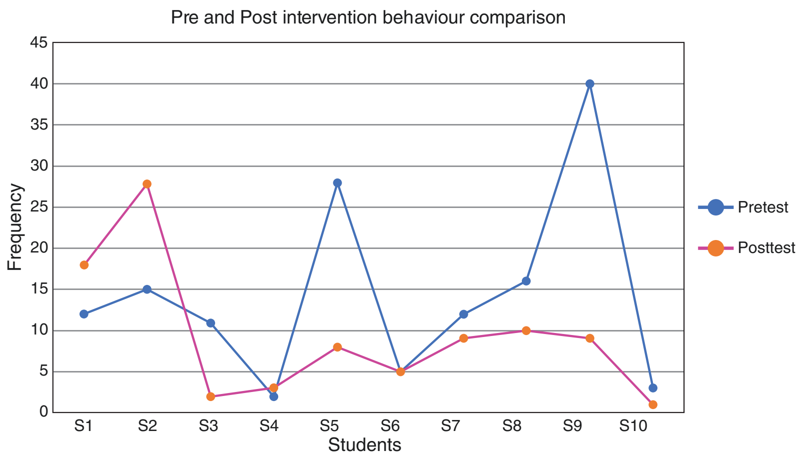

Fig. 3.2 Changes on 'at-risk' adolescent behaviour

In the first term of 2007, I was appointed head teacher/principal and I wasted no time in introducing an incentive scheme:

- If the students turned up to school, they were fed a hearty breakfast;
- If they participated in the short exercise program which included Brain Gym® exercises, they gained access to the classroom;
- If they managed to stay in class for the combined literacy/cooking lessons, they received lunch;
- If they managed to stay in class for the Numeracy/Life Skills, they could access daily rewards after lunch that included ‘Sailability’ on Monday at the local lake, Police Citizens Youth Centre activities on Tuesday, Fitness Centre on Wednesday, cultural activities on Thursday and outdoor education on Friday.

I also invited local Elders frequently to the centre, to provide cultural activities as positive role models. As the student attendance improved, I set about fulfilling the school’s mandate to prepare young people for life in the community given they would not return to a mainstream educational setting. Fortunately, the centre contained a small hall and canteen and *The Coffee Den* project was launched. The students were given an opportunity to complete a National Training Package Certificate 1 in Hospitality (Food and Beverage).

This project gave students the opportunity for ‘hands-on learning’ and to gain relevant industry experience, communication and employability skills in a simulated small business setting.

Emotional skills were built through teamwork that fostered self-confidence, self-esteem and interdependence.

The Coffee Den operated between 8.30 and 12.30 pm that provided coffee and catering for the various professional learning events, which occurred during the week in the adjoining district office. The project was funded through a Lighthouse Grant ($10,000), and the partnership was formalised into an ongoing Management Committee. Within 3 years of introducing food and exercise, Indigenous attendance increased by 90%. I received a Regional Director’s Award for School Achievement in 2009, for improved home/school partnerships, improvements in literacy and numeracy and raising school attendance. This award inspired me to work more closely with Indigenous students and their families, so when I returned back to my rural home it set the theme for my subsequent research projects in the school, where I currently lead as the school principal.

Gumbaynggirr Pathways to Learning (2012–2013)

The aim of this project was to collaborate with local Gumbaynggirr Elders and stakeholders on an educational walking trail within the school grounds. This involved restoring remnant bush habitat within the school grounds with the aim to promote biodiversity values through the ‘accessible’ concept of bush tucker and medicinal plants. Students became the tour guides, sharing Indigenous knowledge at the cultural interface between Aboriginal and non-Aboriginal cultures. The project strengthened local Aboriginal families with the school and education providers and also improved educational learning outcomes for their children. Principals and participants understood the benefits of Indigenous people as an important regional resource.

The project was supported through a PaCE grant funded by the Department of Education, Employment and Workplace Relations (DEEWR). This grant was a significant win because it supported community-driven involvement for parents and careers of Aboriginal and Torres Strait Islander students and young people up to the age of 19 years. Not only did this project connect communities, but also it offered vocational experiences for TAFE students on building the Bush Tucker Track and associated learning spaces throughout the bush habitat. This involved students, 80% of whom were Indigenous, to experience weekly skills training for their Certificate 2 in Construction. This was essentially a vocational pathways program where the students were able to design and construct a pathway through the habitat in a sustainable way. This project also informed a tertiary and further education (TAFE) teaching program that helped shape strategic thinking on employment, training, improved health and school attendance. This unique training program has been implemented across other schools and regions (Figs. 3.3 and 3.4).

Furthermore, I secured local, state and federal funding to ensure the success of this project as an ongoing enterprise. With our Deadly Aboriginal team, we managed

Fig. 3.3 Outdoor 'classroom'

Fig. 3.4 Yarning circle

the consultancy and reviewed logistics and stakeholder feedback. As a result, the school was one of 15 schools in NSW in 2016 recognised by NSW Local School Local Decisions, for our successful and innovative community engagement partnerships. This widely available document affirms the value derived from Indigenous delivered environmental projects and the socio-economic benefits for Aboriginal people engaged in these activities.

Reaching Out Reaching In (2014)

Through the Gumbaynggirr Pathway to Learning project, the relationships that I forged fostered a greater understanding of local Indigenous culture, historical perspectives and Indigenous knowledge systems. Partnering with Southern Cross University resulted in $4000.00 funding through the School of Education Grants program to facilitate diverse yet rigorous research activity within our school. This project was significant because it facilitated the embedding of Indigenous perspectives in a culturally responsive, integrated and cross curriculum manner—a key priority of the new Australian Curriculum K-6 Syllabus.

The project developed students' understanding and competences on rich learning through local Indigenous narratives. In addition, students designed 'garden rooms' and planting of bush tucker and medicinal plants along the track throughout the

Fig. 3.5 Habitat and walking tracks

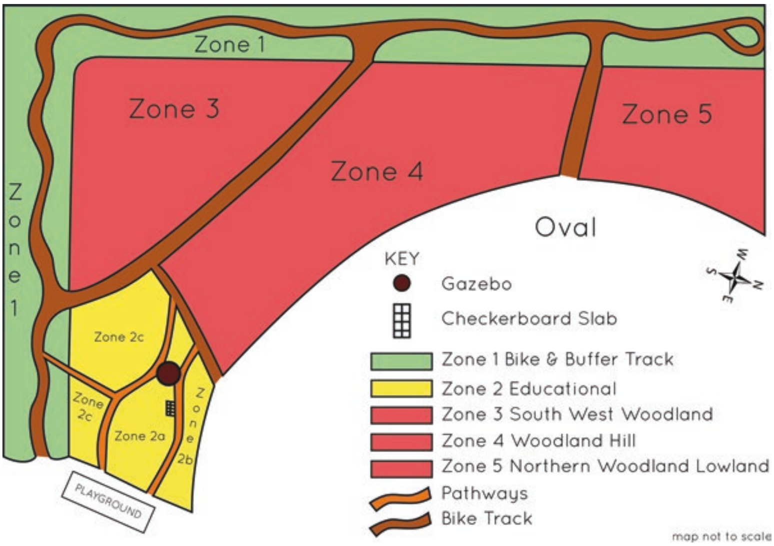

Fig. 3.6 Garden design rooms

habitat according to their assigned garden room area (Figs. 3.5 and 3.6). Nature journaling was used to document the native plants through fieldwork in the garden and learning about botanical science concepts (see Chap. 20 for more detail on the research project).

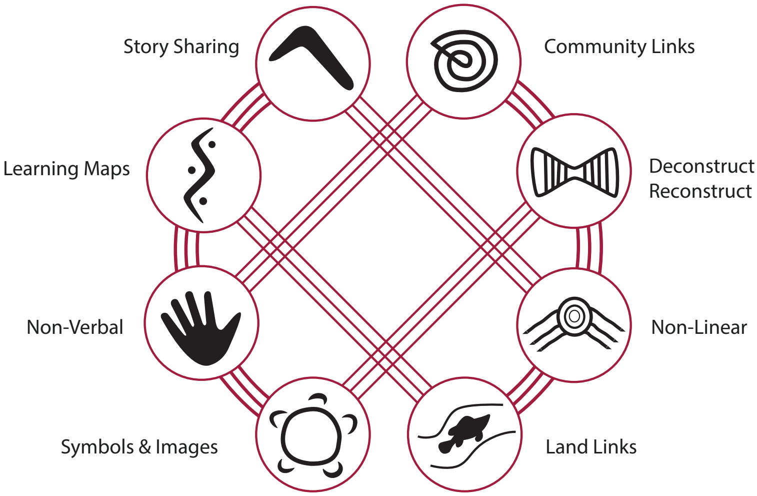

Fig. 3.7 The eight aboriginal ways of learning

The integrated teaching program connected learning to local values, needs and knowledge through interactive learning and non-linear processes from kindergarten to Year 6. Non-linear processes drew on the eight ways of learning framework (Fig. 3.7) that illustrates in a localised context Aboriginal ways of knowing, doing and being and the relationships that sustain it (Department of Education and Communities, 2012; Yunkaporta, 2009).

Students learnt how to be 'place-responsive' and to respect the importance of sustainable environmental practice. A part of this learning included 'Aboriginal Lore' where certain protocols before entering the garden were followed that involved wearing red headbands, which signified 'respect for yourself and your environment' and connected the students as a cohesive group of learners. This project recognised an untapped opportunity for cultural learning about ancient plant types through and with local Elders and provided opportunities for students to learn the value of knowledge of such plants. Correspondingly, 'Aboriginal social capital and protocol was significant to this research because their intrinsic link with "country" provided an insight into Aboriginal customs as knowledge holders' (Turner, Wilson, & Wilks, 2018). As a result, we realised that explicit Aboriginal teaching by Elders improved outcomes for Indigenous learners and that there is common ground between Aboriginal education and the optimal teachings for all learners (Indigenous and non-Indigenous).

STEM in the Garden (2017)

This project was cross-cultural and multidiscipline in design that built capability in teaching and learning to create awareness on food sustainability in rural and remote school communities. Accordingly, the project drew on the Bush Tucker garden as a vehicle for students to learn about science, technology, engineering and mathematics (STEM) disciplines and the knowledge, skills and technologies that are assigned to these learning areas. It was a collaborative project between a collegiate of two other primary schools and Southern Cross University. All schools were from different geographic regions across the mid north coast and north coast regions, NSW, Australia. The project aimed to increase children and young people's understanding of sustainable food systems in relation to grown food. Three varieties of Australian native plants (containing both edible and medicinal properties) were shared between the schools with the premise to understand how the same plants adapt to changing weather patterns and different geographies. This project was funded ($19,000.00) through the Department of Education Rural and Remote Communities, one of the two successful applicants in the mid north coast cluster.

Students and teachers were actively engaged through working scientifically (inquiry-based hypothesis), technologically (digital microscopes and robotics), engineeringly (biotechnology) and mathematically (measurement, data collection and statistics). Communicating between the three schools occurred at the conclusion of the project through a connected classroom platform where students shared their findings and stories from the project.

The collaboration produced an environmental education program for Stage 3 primary school students with a focus on climate change issues. As a result, the project benefited the teachers as a platform to demonstrate particular stages for career advancement according to the Australian Professional Standards for Teachers (AITSL, 2017). Further to this teaching agenda, the Australian Curriculum's Sustainability Cross Cultural Priority advocates for students 'to develop knowledge, skills, values and world views necessary for them to act in ways that contribute to more sustainable patterns of living' (Australian Curriculum Assessment and Reporting Authority, 2016). More specifically, the Australian curriculum advocates the need for children to learn about food and fibre principles and capacity building on food literacy connections between food and fibre, health and wellbeing.

External Initiatives Regularly Run in the School (2012–2019)

The following initiatives have been ongoing because they provide vital engaged learning that supports eating healthy and nutritious foods combined with regular exercise.

The Live Life Well @ School program is a collaborative initiative that is supported by the NSW Ministry of Health and schools from different sectors: the NSW Department of Education, the Association of Independent Schools of NSW and the Catholic Schools NSW. There are a variety of resources and professional learning opportunities for the teachers on ways to promote healthy eating and physical activity to students. 'The program aims to get more students, more active, more often and focus on healthy eating habits' (NSW Office of Preventive Health, 2019a).

Crunch & Sip® is a program offered by the NSW Healthy Kids Association that helps primary schools to set specific times for students to '"refuel" on vegetables, salad and fruit and "rehydrate" with water' (NSW Office of Preventive Health, 2019b). Teachers are also involved where they may have Crunch & Sip® time while students are working on activities or stop work and hold a specific activity inside or outside of the classroom.

Fruit and Veg Month is an event that promotes health in NSW primary schools, funded through NSW health. It specifically focuses on fruit and vegetables (Nutrition Australia, 2019a).

National *Nutrition Week* is an annual campaign designed by *Nutrition* Australia. The campaign aims to encourage Australians to increase their vegetable consumption to the recommended five serves per day, which also feeds into primary and secondary schools (Nutrition Australia, 2019b).

Walk to School Day is an annual and national initiative provided by the Pedestrian Council of Australia. The central tenet is to ensure primary school children are encouraged to walk or commute safely to school with either a parent, relative or carer (Pedestrian Council, 2019).

Conclusion

With the escalation of mental health and behaviour disorders in Australian schools, there has been a loud call for school educators to combine physical education and nutritional learning perspectives in order to improve a student's neurological capacities (Hardy, Mihrshahi, Drayton, & Bauman, 2015). When I reflect on my work undertaken over the years, one thing that is core to all of this is that the solution to unlocking a student's greatest learning potential occurs when their curiosity is awakened through food and exercise. I have witnessed first hand how stress can destroy our capacity to awaken our mind (The Resilience Institute, 2019) compounded with a lack of exercise and a feeling of hopelessness when our needs are not met physiologically and emotionally. I have a passionate belief that linking physical movement with access to food and food activities increases student engagement, produces successful learning outcomes and creates pathways for students to overcome obstacles to excel to new levels. This approach has been key to my work in schools since 2004 culminating in 2018, being recognised by the NSW Primary Principals' Association State Council (NSPPA). They unanimously endorsed that Scotts Head Public School Community is a worthy recipient of the NSWPPA Aboriginal Education Award:

> Gillian Stuart has made a significant difference to the Aboriginal students and community at the local School, evidenced by the strong emphasis on Aboriginal culture and histories. Students are engaged in a variety of programs that focus on Aboriginal Education. In consultation with Elders and respected community members, various stations have been created in the playground which act as hubs for each aspect of the 8-Ways of Aboriginal Learning….Through programs which heavily involve the local community, students are very knowledgeable about each aspect and are regularly called upon to take guided tours

through their school with visiting teachers, principals and dignitaries. There are yarning circles, bush foods stops through their Bush Tucker Track and various interpretive spaces built in partnership with TAFE and at-risk Aboriginal High School Students. These projects have provided genuine pathways for young Aboriginal men to gain certified skills, which may lead to meaningful employment in the local area as well as provide visible positive role-models for the school's younger male students. Local Aboriginal artists have been engaged to work with all students in linking the seasonal knowledge and local cultural aspects with the school by creating colourful artworks which feature across the school's grounds. Gillian Stuart's work and enthusiasm have changed community attitudes and formed a cohesive school community.

My foresight, coupled with my leadership skills, has significantly contributed to increasing quality outcomes for Aboriginal and non-Aboriginal students under my wing over the years, and as such the investment in these projects has formed my life's work as ongoing well beyond the school gate.

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Chapter 4
What Is the Current State of Play for Food Education in English Secondary Schools?

Ruth Seabrook and Vanessa Grafham

Abstract Secondary school food teachers have faced a period of unprecedented change in England. With recent fundamental changes to the National Curriculum (NC) for design and technology (D&T) and for food technology, food education is going through a crisis in secondary schools.

These changes are in the context of the government's new school accountability measures—Progress 8 and Attainment 8 (Department for Education, 2016)—and the privileging of academic subjects in the curriculum through the introduction of the English baccalaureate. This chapter will describe each of these features and use the research findings from a national questionnaire by the authors to assess what the general situation is across schools in England.

National questionnaire: current views on food teaching (Appendix 1)

The authors distributed a national questionnaire to as many education contacts as possible. This was to gather as wide a picture of the current climate for food education provision. Nineteen responses were received from schools spread out across the UK. It investigated what provision there is at Key Stage 3 (KS3) (pupils aged 11–14 years in food) and the available options for pupils at Key Stage 4 (KS4) (pupils aged 14–16 years) and what is the uptake of these opportunities by pupils. The questionnaire attempted to ascertain what options there are available to students at Key Stage 5 (KS5) (pupils aged 16–18 years) and if there is variability for such courses across England. This research also hoped to highlight changes in lesson timetabling for such courses by Key Stage and how this would impact upon the range of practical versus theory teaching strategies that are possible.

Case studies: in-depth view on food teaching (Appendix 2)

Three case studies provided by food teachers from secondary schools around the country in London, Cornwall and Derby were also used to more deeply explore and

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understand 'the state of teaching food' in secondary schools in England. The case studies particularly highlighted the changes in uptake of such courses across the secondary school phases.

Keywords Secondary education · England · General Certificate of Secondary Education (GCSE) · National Curriculum (NC) · Food education

How Did Food Education Begin in English Schools?

Historically food has been in the English school curriculum since the mid-nineteenth century. Its aim was to teach cooking skills to girls so they could provide for their families and to prepare them for domestic service (Lawson, 2013). During the twentieth century, the subject developed with the aim of being to prepare nutritious and affordable family meals.

In 1926, the Howden report stated that the 'general aim should be to provide practical instruction in the choice and preparation of the food required for a simple wholesome diet, with due regard to home conditions and the need for economy' (Central Advisory Council for Education (CACE), 1926, p. 235). Grammar schools taught girls domestic science with greater emphasis on nutrition and science. In 1945, following the Second World War, the new secondary modern schools for pupils that had not passed the entrance examination to grammar schools thought that the health of the nation was vital and those girls should learn to cook (Rutland & Barlex, 2006). There was little change until the Newsome report (CACE, 1963, p. 389) found that 'housecraft and needlework justified their place in the curriculum for most girls'. This was suitable at a time in society when most girls went on to become homemakers. In 1975, the establishment of the Sex Discrimination Act resulted in more boys being encouraged to enrol in food-related subjects, and with the advent of food technology, more boys did engage with the subject, but still by 2010, this was still only 36% (Design and Technology Association (DATA), 2010).

By the mid-1980s, domestic science had evolved into home economics (HE), but broadly speaking it still held a strong focus on preparing nutritious and cost-effective meals and was studied predominantly by girls. In 1990, Technology was introduced with the advent of the NC (Department for Education and Schools (DES), 1990), and HE was retained within the D&T section of technology and transformed into food technology. Food education changed, moving away from cooking and nutrition, and became more broadly based around industrial practice and scientific and technological principles. The British Nutrition Foundation (BNF) welcomed this change in the curriculum and thought that food technology would teach scientific principles to pupils in a clearer and more easily communicable manner. With the foundation of the 'Healthy Schools' initiative in 1999 there was now focus predominantly aimed to improve not only food education but also the wider issue of all foods available to all children in school (Department of Health (DoH) & Department for Children, Schools / Families (DCSF), 2007).

The 1990 Education Act introduced Technology, which included D&T and information technology (IT). Food was included within D&T. With the following N/C revision in 1995, Technology became D&T and IT, and the two were considered separate subjects (Department for Education/Welsh Office (DFE/WO), 1995). Many teachers found themselves at odds with the teaching of food design within D&T. There was little training for previous HE teachers, and many felt alienated from a curriculum that seemed to have little reference to food and contained such words as designing, artefacts, systems and mechanisms (Rutland & Barlex, 2006). Less 'practical making' and more designing tasks where pupils 'drew' food meant that the subject lost status and direction. Rutland and Barlex (2006) argued though that designing in food was very different to that of other D&T areas. It involved brainstorming, questionnaires, product attribute analysis and modelling of food ingredients. Owen Jackson (2007) went on further to say that food design related more to product development and involved working with actual food ingredients rather than simply drawing them. Food technology remained within D&T through changes in the N/C in 1995, 1999 and 2007, although it has always had a rather chequered history, as we will go on to discuss in the next section.

Recent History 1995: To Present Day

Since one of the authors began a career in teaching in D&T in 1998, there have been some very fundamental changes to the subject, most significantly in respect to changes to food technology and the methodology of teaching the subject. Initially, there was a compulsion for every pupil in England to follow a technology subject at General Certificate of Secondary Education (GCSE), and food technology was a very popular choice, although more so by girls than boys:

> Though, food technology still suffered from being a subject perceived as being 'for girls' and as a subject with more vocational relevance than academic
>
> (Owen-Jackson, 2013, p. 106).

The Specialist Schools Programme (1993) introduced the concept of 'Technology College' status, and technology played an important part in the politics of education (Gove, 2010). The government awarded this status; however, in 2004, although there were many technology status schools, the government decided to remove the requirement for pupils to study a GCSE in Technology, and many teachers felt this was the start of the slow decline of the subject. Personal experience of this was going from teaching four classes of GCSE food technology to just one within 1 year of this change. This is a similar situation to that of the London case study school as below:

> Our school became a specialist school for Design and Technology in 2009, and remained so until government funding ceased in April 2011. During the time of being a specialist school all students were required to take a D&T subject for GCSE. For food, options of choosing Food Technology or Catering were available. During this time the school had approximately 100 students taking a food focused GCSE. With the advent of the withdrawal of specialist status, students were no longer required to take a D&T GCSE option. The school continued to offer both GCSE options and an average of 40 students took one.

> From 2014, only food technology was an option choice, before its removal and change to Food Preparation and Nutrition (In-depth view on Food Teaching - London Case Study School, 2018).

However, the government continued to look at societal health problems through the 'Health of the Nation' white paper (Department of Health, 1992) and felt that there was simply not enough quality food education happening in many schools in England. In fact, one in five children who joined primary school in 2015 were obese or overweight (Huffington Post UK, 2015). However, some good news showed that the proportion of teenagers having chips for lunch plummeted from 43% to 7% (Children's Food Trust, 2015).

Many charitable organisations have supported food education in England. These include Jamie's School Dinners, The School Fruit and Veg scheme, the Every Child Matters agenda, Let's get Cooking Campaign, the Healthy Schools initiative, the Soil Association, Food for Life, Jamie Oliver's kitchen garden project, Change for Life, the Countryside Classroom, the British Nutrition Foundation and the Food Teachers Centre. Why then is it that most of these are charitable organisations with no funding from the government, and how has this impacted on food in the school curriculum?

In 2008, the current Secretary for Education, Ed Balls, brought in the 'Licence to Cook' (DfE Licence to Cook programme, 2007–2011) programme. This initiative intended to give all pupils at least 8 h of cooking each school year. The main issue here was that where there was excellent food technology teaching taking place, in some cases it was replaced by the 'Licence to Cook' programme, which was by far less scientific and led to an impoverished learning experience for pupils. Rutland (2008) reviewed the scheme and deemed that it led to issues with progression from KS3 to KS4 (11–16 years). Food technology began to lose its focus, and as Lawson stated there was a need to 'make food technology more relevant and challenging for pupils in the 21st Century' (2013, p. 101). There was a need in Year 7 (pupils aged 11 years) to capture their interest and imagination and ensure there was no repetition of their previous experiences in primary school. Their learning should build on existing knowledge and deepen their understanding of how nutritional properties of food contributed to their health and well-being, engaging them fully.

Fundamentally, the DfE's School Food Plan (Department for Education (DfE), 2013) called for a whole school food approach/culture, recognising that neither balanced school meals nor food education alone was sufficient to enable children to live well and eat healthily.

The Revised National Curriculum in England: D&T Programmes of Study (PoS) (DfE, 2013)

The revised D&T PoS (DfE, 2013) has a separate 'Cooking and Nutrition' section as a compulsory part within the D&T curriculum for pupils aged 5–14 years, and it has had a major impact on food education in England. However, it is important to note that food/ingredients remained as a material in the D&T PoS for KS1–3 (5–16 years).

Teaching pupils how to cook and apply the principles of nutrition and healthy eating is the main aspect of the new PoS. Learning how to cook is a crucial life skill that enables pupils to feed themselves and others affordably and well, now and in later life. They should be taught to:

- Understand and apply the principles of nutrition and health.
- Cook a repertoire of predominantly savoury dishes so that they are able to feed themselves and others a healthy and varied diet.
- Become competent in a range of cooking techniques (e.g. selecting and preparing ingredients; using utensils and electrical equipment; applying heat in different ways; using awareness of taste, texture and smell to decide how to season dishes and combine ingredients; adapting and using their own recipes).
- Understand the source, seasonality and characteristics of a broad range of ingredients.

The Impact of Changes in the English National Curriculum

In 2017, one of the authors having taken part in an examination board presentation for the new D&T GCSE found it very disappointing that there was no mention of food education and there was no information regarding it forthcoming from the session. It was almost as if the examination board had completely disregarded the link between D&T and food.

The most recent accelerated decline in D&T numbers links, in part, to the narrow curriculum focus due to the high status of the English baccalaureate (EBacc). The government introduced the EBacc in 2010, and the proportion of pupils entering into the EBacc almost doubled in recent years, rising from 22% in 2010 to 39% in 2014 (DFE, 2015c):

> We will require secondary school pupils to take GCSEs in English, maths, science, a language and history or geography, with the Office for Standards in Education (Ofsted) unable to award its highest ratings to schools that refuse to teach these core subjects (Conservative Party Manifesto, 2015).

In terms of initial teacher education (ITE), it increased the shortages of those training in EBacc subjects as the government had previously restricted the number who could train in these subjects. This led to a large rise in the bursary payments for those subjects to attract more candidates into teaching. Lower numbers were then allowed to train in non-EBacc subjects combined with a withdrawal of the bursary altogether for the majority of subjects including D&T, art and design, music, drama and physical education (PE).

Pupils study the ‘core’ academic subjects of English, mathematics, science, a modern foreign language (MFL) and either geography or history as a humanities subject. They are given far fewer options at GCSE level as all the remaining ‘creative subjects’ are collected in one or two option blocks, allowing little choice for pupils (Turner, 2017). ‘The likelihood was that the arts, technology, physical education and religious studies would be lost to accommodate compulsory history and geography' (Schools, Students and Teachers network (SSAT), 2015). The government's ambition is to see 90% of GCSE pupils choosing the EBacc subject combination by 2025 (DfE, 2015c), and this will surely have an ongoing impact for the uptake of D&T and especially food in the coming years:

> The ability of students being encouraged to take the subject has declined as higher pathway students have more limited option choices therefore we cannot compete against languages and the triple science pathway
>
> (Current views on Food Teaching, Teacher B 2018a)

> Food is a popular subject at KS3 however many do not choose it for GCSE, as they are limited by the number of subjects that they can choose.
>
> (Current views on Food Teaching, Teacher C 2018a)

The additional impacts on food teaching related to the time allocation for lessons:

> When lessons are only fifty-five minutes long, there is little time for practical of any great skill, importance and that is scientifically nutritionally sound
>
> (Current views on Food Teaching, Teacher D 2018a).

> In my first school food teaching reduced to one hour per week. This was then reduced to fifty minutes, a nightmare for food teaching' In my current school students get 18 weeks of cooking and nutrition through the whole of their secondary school education – I do not feel this is enough
>
> (In-depth view on Food Teaching, Cornwall case study school 2018b)

The British Nutrition Foundation (BNF) felt that 'there is still a long way to go and in many schools nationwide, the picture of food education gives cause for concern' (BNF, 2017).

The AKO Foundation (a registered charity whose primary function is to award grants to projects that seek to improve education) commissioned the Fell report (2017). In a combined study by the Jamie Oliver Food Foundation, the BNF, the Food Teachers Centre and the University of Sheffield, they undertook a comprehensive review of the state of food education in England.

In the report (2017, p. 29), questions posed include 'how well are pupils enabled under the new NC to develop key knowledge and skills through their food education' and 'are they able to put this knowledge learnt into practice'. It was clear from the report that although secondary pupils were able to describe the principles of a healthy diet, they experienced challenges in applying this learning. There is further evidence put forward in the report (2017, p. 44) that for curriculum-based food education to have a maximum impact, it needs embedding within the wider school food culture. Although some schools adopt a whole school approach from the teaching of the subject in D&T through to the school canteen and breakfast/dinner clubs, this is all too rare a situation and there is little or no 'joined-up thinking' in schools. 'Experiential learning can support learning outcomes' (2017, p. 37) where pupils who are taught the essentials of healthy eating in the classroom are then able to put

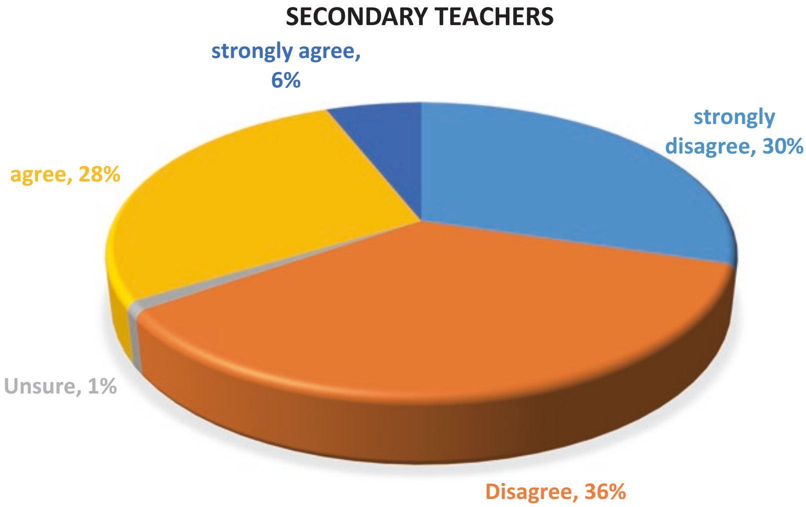

Fig. 4.1 Time as a barrier to delivering high-quality food education (2017, Fell Report, p. 39)

this in to practice through ingredient and recipe changes in class, lunch choices or snacks between lessons.

According to the Fell report (2017), there is a great deal of variability in the delivery of food and nutrition education, with really stark differences between those schools delivering really robust food education and those who are struggling due to a lack of time, resources and support. Food teachers report that a lack of training time, curriculum class size, budgets and facilities has a significant impact on both the quality and quantity of food lessons (Current views on Food Teaching, *Teacher D* 2018a).

Figures from the Fell report show that 50% of secondary teachers reported that pupils have between 11 h and 20 h per year at KS3, with nearly 16% reporting pupils have less than 10 h (2017, p. 39). Time both in terms of total time allocation for each food lesson has hampered teachers' ability to deliver not only the breadth of the curriculum but also to an adequate depth:

> Time is a massive factor on the food that can be prepared and cooked in lessons. Hour lessons are ridiculous, stressful and constraining
>
> (Current views on Food Teaching, Teacher E 2018a)

As can be seen from Fig. 4.1, 66% of teachers felt that there was insufficient time for adequate food teaching in schools.

Current Views on Food Teaching Results from Author's National Questionnaire 'Current Views on Food Teaching' (2018a) (Appendix 1), Case Study Schools' 'In-Depth View on Food Teaching' (2018b) (Appendix 2) and the Fell Report (2017)

From the questionnaire responses (19), there appears to be even greater disparity in schools with some pupils receiving 12 h or less but others as many as 55 h provision per year for KS3 (11–14 years) and up to 100 h for KS4 (14–16 years), which is a huge variance and does nothing to instil confidence in the quality of provision. Anecdotally, teachers spoken to (whilst on visits in school) have expressed the opinion that where their head teacher has understood the value of the subject, the timetabled hours and budgets have been higher and there has been less predominance on the EBacc subjects. Where this allegiance to the subject is lacking, the opposite outcome is seen (Current views on Food Teaching, 2018a).

From the figures in the questionnaire, there would appear to be a good ratio of practical versus theory with 71% of teachers saying pupils at KS3 (11–14 years) carried out practical tasks once a week and 29% only every 2 weeks (Current views on Food Teaching, 2018a).

Budgets cause a huge amount of stress for senior managers, and respondents felt this was a huge challenge to delivering high-quality food education. Concerns raised included not being able to replace broken equipment, repairing unsafe teaching rooms or providing ingredients for pupils. More than 65% of teachers said their budget had decreased over the last 3 years, and 47% said it was to reduce even further. Less than 50% said they had sufficient facilities or resources to deliver the curriculum to a satisfactory standard (Fell Report, 2017).

Class size is a key factor in the challenge of food education: 'you cannot assess a class of 26 pupils all cooking at the same time' (Current views on Food Teaching, Teacher F 2018a). In more than 50% of schools, the ratio of cookers to pupils was 1:3 or less, often with not all the cookers working at one time (Fell Report, 2017). The questionnaire showed that in 40% of classes, there were more than 30 pupils at KS3, which is a real concern, especially for health and safety, and this would ultimately affect the quality of experience for the pupils and perhaps deter them from choosing the subject at GCSE (Current views on Food Teaching, 2018a).

In addition, 92% of secondary school teachers felt that food should be taught by specialist teachers, and many reported this was not the case (and given as a reason for the subject being removed from their school curriculum), and in some instances there were no food specialists at all delivering food education. Many teachers aspire to having food education as having higher status and want it to be valued as an integral part of the curriculum, instead of it being looked at as a lesser subject with little importance.

The New GCSE Food Preparation and Nutrition for KS4 Pupils (Aged 14–16 Years)

A key development has been at KS4 (14–16 years) where food technology as a material area within GCSE D&T courses was replaced with a new GCSE qualification *food preparation and nutrition* (DfE, 2013). The change from food technology to ‘cooking and nutrition’ was unacceptable for the new GCSE however, and it changed to ‘food preparation and nutrition’. This reflected the feedback from all quarters on the use of the word ‘cooking’ within the title whilst still being clear that the qualification would teach students practical cooking skills.

There was a delay in the introduction of the new D&T GCSE until September 2017, which was due to the vociferous response from those in education who identified the flaws in the new specification. However, the new food preparation and nutrition GCSE, with first examination in 2018, began in 2016 (DATA, 2015). The DFE (2015a, p. 19) felt ‘this new GCSE is a general qualification which will enable progression to a wide range of further qualifications and careers in the food industry’.

In response to this, in the author’s questionnaire, 71% of the teachers felt that there was insufficient provision at KS4 and 87% insufficient at KS5 (Current views on Food Teaching, 2018a).

If we look at the national figures in Fig. 4.2 for food technology GCSE entries over the last 5 years, there has been a steady decline in the uptake numbers for food technology from 44,642 in 2013 to 29,773 in 2017. This is a percentage drop of 33.31%, which is alarming to say the least (DATA News, 2015).

However looking at the Joint Council for Qualifications (JCQ) (2018) data, it shows that 49,748 pupils sat the new GCSE food preparation and nutrition qualification in 2018, which would appear to be a large increase. This figure though must be taken in relation to other qualifications in food that were no longer available to pupils, typical example in Fig. 4.3.

Concurrently, if we look at the national figures in Fig. 4.3 for the hospitality and catering numbers during the same period, these are the only vocational food qualifications compiled in this manner to compare with the GCSE. There is also a significant drop between 2013 and 2017 from 868 to 338 entries. This is a percentage drop of 61%, which is even more alarming. Interesting in 2017, although the figures were lower than the previous year, the percentage of pupils completing a vocational food qualification rose to 35% from the previous year of 22% of the total entries. This could indicate that a number of schools were moving away from the new GCSE in food preparation and nutrition and undertaking hospitality and catering instead, perhaps due to the higher level of science and maths in the new GCSE.

Exam Board	2013 Food technology Entry	2013 A*-C%	2013 A*-G%	2014 Food technology Entry	2014 A*-C%	2014 A*-G%	2015 Food technology Entry	2015 A*-C%	2015 A*-G%	2016 Food technology Entry	2016 A*-C%	2016 A*-G%	2017 Food technology Entry	2017 A*-C%	2017 A*-G%
AQA	35,183	61.8	99	32,322	61.3	98.9	30,570	60.5	98.8	26,773	60.5	98.8	23657	60.6	98.9
Edexcel	2,743	66	98.9	2,607	62.2	98.6	2,378	65.6	97.7	1,967	66	99.4	1,691	63.9	98.8
OCR	5,360	62.3	99.1	4,695	63.2	99.2	3,945	63.2	99.4	3,262	62.9	99.2	2,868	60.67	99.3
WJEC	1,356	64.7	98.5	1,480	65.9	96.6	1,654	64	99	1,721	61	98.2	1,557	64	99.1
CCEA															
Entry/focus area	44,642			41,104			38,547			33,723			29,773		
% of total FC entry	20.2			19.1			18.7			18.1			17.8		

Fig. 4.2 Food technology GCSE entries

	2013 Hospitality & Catering Entry	2013 A*A*-CC%	2013 A*A*-GG%	2014 Hospitality & Catering Entry	2014 A*A*-CC%	2014 A*A*-GG%	2015 Hospitality & Catering Entry	2015 A*A*-CC%	2015 A*A*-GG%	2016 Hospitality & Catering Entry	2016 A*A*-CC%	2016 A*A*-GG%	2017 Hospitality & Catering Entry	2017 A*A*-CC%	2017 A*A*-GG%
	868	65.3	100	730	62.9	100	498	70.9	99.8	353	65.4	99.5	338	71.3	99.7
Entry	868			730			498			353			338		
% of total FC entry	26.3			25.8			24.6			21.7			34.9		

Fig. 4.3 Hospitality and catering vocational courses

The government reformulated GCSEs to make them more in line with international standards (Food Teachers Centre, 2018). In 2018, the first cohort of the new GCSE food preparation and nutrition went through. The Office for Qualification and Examinations Regulation (Ofqual) and the examination boards ensured that results compared fairly to those of previous years, so the candidates were not disadvantaged. Indeed the overall outcomes were 62.3% at grades 4–9 (equivalent to A–C) with 70% of all girls and 48% of all boys attaining grades 4–9. This is the same as the previous years' results of 62.3%, taken as an average across all examination boards.

With the new GCSE being harder in nature, with a higher percentage of scientific and mathematical output along with more in-depth nutritional knowledge and more complex practical skills, there is concern that those lower ability pupils will have no alternative options. Food has always been very successful as its practical nature can motivate, inspire and provide success for pupils with special educational needs. This is especially pertinent now as Ofqual (2018) is not approving entry-level qualifications and school leaders are opting for only those subjects that fall within Progress 8 assessment criteria:

> The subject is popular but can sometimes be under pressure as it is an academic school and this is not always viewed as an academic subject despite the new scientific content
>
> (In-depth view on Food Teaching - Derby Case Study School, 2018b)

In summary, there is currently no longer a wide range of choices for food courses at GCSE level. Those available currently (at the time of writing) include:

- GCSE food preparation and nutrition from exam boards:
  - The Assessment and Qualifications Alliance (AQA)
  - The Welsh Joint Education Committee (WJEC)—branded EDUQAS
  - The Oxford, Cambridge and RSA Examinations Board (OCR)
- WJEC hospitality and catering at Level 1 or 2 (Level 2 is equivalent to GCSE)
- City and Guilds Level 2 Award in Cookery and Service
- WJEC Food Science and Nutrition Certificate and Diploma Level 3 (equivalent to A Level as no A Level available)

Summary of the Specifications for the New GCSE Food Preparation and Nutrition

When introducing the GCSE, each examination board refers to the development of cooking skills and the ability to make informed choices. The *specifications* have clear similarities. There is an emphasis on nutrition and health, and students develop their understanding of macronutrients, micronutrients, energy needs, nutritional analysis, diets for specific needs and making informed choices to limit major diet-related health risks. A second key area is food science, through which students develop their understanding of the functional and chemical properties of ingredients as well as the effect of cooking on sensory characteristics. There is an emphasis on food safety as a requirement to learn about the principles of food safety as well as food spoilage and contamination. Each specification includes sections related to food provenance and choice. The WJEC and OCR specifications are more explicit with regard to ingredients that should be studied, both making it clear that it is the major commodity foods that should be studied. Food preparation skills are fundamental to all the specifications. Each is specific about what skills and techniques are to be included, and there are clear similarities between these. There is also far greater emphasis on the development of 'food preparation skills' which has caused a deficit in the area of developing new food products and use of emerging ingredients and techniques compared to the previous food technology GCSE:

> However, the time scales suggested by the exam board are very difficult to achieve in sufficient detail. As we do not have longer double lessons, preparing for the new three-hour practical exam is also more difficult as the students are not used to working for this length of time. Mock exams are scheduled for the summer term in Year 10 to give them this experience at least once ('in-depth view on Food Teaching - Derby Case Study School, 2018b).

The *overall structure of assessment* is the same across all the examination boards. Each has a written paper that is worth 50% of the grade. Each has two non-examined assessment (NEA) tasks. The first of these worth 15% is a food investigation task.

This requires students to demonstrate their understanding of the functional and chemical properties of ingredients. The examination board sets the focus, where students are required to plan, carry out and evaluate practical investigations. There is some variation in the time allocation from 8 h to 10 h. The examination boards also set the food preparation task and this is worth 35%. The task requires students to demonstrate their ability to plan, cook and prepare a selection of dishes. The time allocation varies from 12 h to 20 h. This also includes a 3-h practical exam in which students are required to make three dishes.

The *written papers* vary slightly in structure. The AQA exam is in two sections: the first section includes only multiple-choice questions. The second section includes five questions with a number of sub-questions, some of which require students to give extended answers. The WJEC exam paper is also in two sections: the first section typically includes questions based on visual stimuli, for example, images of different stages of making a recipe with the questions based on the recipe. The second section includes a range of question styles, some of which require extended answers. The OCR examination paper is not in sections and includes a range of questions. As with the other boards, some of these require extended answers:

> The new GCSE food preparation and nutrition course is very complex. I do feel the nutrition and dietary related disease aspect is superb. The intensive food science section I feel goes into too much depth and should be an aspect to be taught at 'A' level
>
> (In-depth view on Food Teaching - Cornwall Case study School, 2018b).

Examination Courses for KS5 Pupils (Aged 16–18 Years)

At KS5 (pupils 16–18 years), the opportunity to take General Certificate of Education (GCE) A Level Food Technology has been removed. Only some vocational qualifications for this now exist:

> At KS5, all U6 students take part in a life skills programme with a survival cookery element. We are now offering WJEC Level 3 at the Certificate level to a small group of 6th form students run as part of the enrichment programme.
>
> (In-depth view on Food Teaching - Derby Case Study School, 2018b)

It is possible for schools to offer City and Guilds Level 1 and 2 courses in hospitality and catering. However, it is not feasible for most schools as there is a minimum requirement for a centre to have at least 100 students studying for City and Guilds qualifications. Only one of the schools who responded to the questionnaire commented they even had contacts with or used a local further education (FE) college to deliver these or similar qualifications (Current views on Food Teaching, 2018a).

One qualification that has remained accredited is the business and technology education Business and Technology Education Council (BTEC), specialist work-related qualification, Level 1 home cooking skills. However, this course does not have performance points. The course focuses on the development of practical cooking skills, and assessment takes place through a portfolio of work.

Another qualification with an uncertain future is the NCFE Level 1 and 2 V Certs in Food and Cookery (NFCE, 2018). These courses are complimentary technical awards and the vocational equivalent of GCSE qualifications. They are for 14–16 year olds who are interested in gaining experience of using different cooking techniques and methods to enable them to use these within further education or apprenticeships. It provides them with a basic understanding of the skills required for a career in food. These qualifications are, in the main, assessed internally, through portfolio work. They are currently DfE approved for Progress 8 and performance tables but will not be past March 2019, when the qualification will expire. Those schools offering the course after this date will not be able to use the results towards their performance tables, hence the uncertainty (Qualhub, 2018).

The Technical awards, which intended to provide a more practical approach to learning about food and were available as Level 1 and 2 awards, are also no longer available. Having not gained government approval, the examination boards removed them, much to the frustration of schools who had already started teaching the syllabus.

Therefore, in terms of a comparison to other subjects, food has only 5 qualifications, science has 49 and performing arts has as many as 62, and even D&T and engineering have 38 (Food teachers Centre, 2018). The majority of schools in responding to the questionnaire indicated that they use AQA (55%) as their preferred board with the Welsh Joint Education Committee (WJEC) and Edexcel second (20%) and National Council for Further Education (NCFE) (13%).

Expertise of the Food Teacher

To qualify as a secondary teacher, student teachers undertake a degree in the related subject they wish to teach. However, this is not always the case for food teachers who may have a degree in a related D&T subject such as product design or textiles, with food being their second subject. According to the BNF (2017), only one-fifth of secondary food teachers had an A Level in food technology, which has to be of concern.

The Department of Education (DfE, 2016) reported that there were only 4500 food teachers across the age range 5–16 years compared to 5300 in 2011 (this compares to 34,100 English teachers in 2016). For the same period for Key Stage 5 (16–18 years), this reduced further to 600:

> ‘There is only myself who teaches KS4 and KS3. Non-specialists teach some of KS3, from history and art. This does not work very well, and I have to pick up all the missed skills and knowledge not provided in the previous year’.
>
> (In-depth view on Food Teaching - Cornwall Case study School, 2018b).

> We are considering removing Food from the curriculum, as we have no specialist teachers and the last year group taking GCSE is Year 11 (aged 16 years). We have excellent facilities and students are keen but we have no way of delivering high quality lessons
>
> (Current views on Food Teaching - Teacher F, 2018a).

In the Public Health England (PHE) and BNF report on 'Food Teaching in School: A Framework of Knowledge and Skills' (2015), a set of standards was established with the expectations and requirements for qualified food teachers, in order to raise the profile of food education in schools. This went on to become part of the Ofsted common inspection framework and aimed 'to promote a whole school "Food" ethos to raise awareness of the integral part food and the whole school approach plays in children's health, well-being and attainment' (PHE, 2015). This should surely improve the situation for the teaching of food in schools.

Conclusion

It may appear from reading this chapter that there is little to be satisfied with food education in England and that the subject is suffering both a crisis of confidence and more importantly existence. However, with so many charitable organisations and dedicated teachers and pupils wanting to study food, it must surely improve with the raised profile of the subject. There are 'stalwarts' who truly value its place in the curriculum, and we must rely on them to keep the subject flourishing and demonstrate how relevant it is in modern society.

There is currently little choice for those students wishing to take food at GCSE level, but with Office for Standards in Education (Ofsted) now venturing to say that the school curriculum has become too constricted and not 'rich and diverse enough', there is an optimism amongst those in the creative subject areas that things are about to change. Schools that are predominantly offering EBACC subjects to the preponderance of others will find they will not considered 'outstanding'.

A more positive aspect seen is with 49,748 pupils having sat the new GCSE food and nutrition examinations in 2018. Total numbers are therefore up from the previous years' examination cohorts, even if we consider the lack of other options available to pupils; it is still an overall increase.

In the London Case Study School and other schools (backed up by anecdotal evidence on visits), some are venturing down the route of considering the GCSE as a 5-year examination pathway. The Schemes of Learning (SoL) being developed are to reflect and allow better progression towards GCSE specifications. The introduction of more food science by the explanation of food processes, in more depth, and the inclusion of class investigations are taking place in Year 7 lessons. The depth of knowledge they require is built from a stronger foundation with more emphasis placed on this through KS3 (11–14 years), leading more satisfactorily onto the KS4 (14–16 years) specifications.

Many schools have also undertaken to start the GCSE classes with pupils in Year 9, deciding that taking more time to cover the specifications over the 3 rather than 2 years will allow pupils to build the depth of knowledge and understanding they require to realise success in their examination outcomes:

> 'Food is very popular at our school, with 5 KS4 groups and KS5 groups also. All pupils study food at KS3. Our results are excellent and behaviour is good in lessons.' (Current views on Food Teaching - Teacher G, 2018a)

Appendix 1

Questionnaire to gather information about the Food & Nutrition provision in secondary schools in England

Ruth Seabrook 2018 - please respond to ruth.seabrook@roehampton.ac.uk

Draft Title: Food & Nutrition Provision in Secondary Schools						
Please indicate if you are a:	Student Teacher		Teacher		University Tutor	
These Questions relate to school provision prior to the introduction of the new National Curriculum(2014)						
Did your school provide Food Technology in KS3 in the old National Curriculum?					Yes	No
Did the D&T department in your school deliver Food Technology?					Yes	No
If the above answer is no, please indicate how Food Education was delivered in your school?	Enrichment	PSHE	Externally delivered (local Chef, Food Bus)		Other:	
Do you have specialist food rooms?					Yes	No
Did your school provide Food Technology as an option in KS4					Yes	No
Did your school provide Vocational qualifications of any kind?					Yes	No
If yes, can you indicate what:						
Which Exam Board did you use? (please tick those that apply)	AQA	Edexcel	OCR	WJEC	Other:	
What was the take up for Food Technology in KS4?	1-10 pupils	11-20 pupils		21-30 pupils	more than 30 pupils	
Did the school provide Food Technology or Vocational courses in KS5?					Yes	No
Which Exam Boards/qualifications did you use?	AQA	Edexcel	OCR	WJEC	Other:	
What was the take up for Food Technology/Vocational Qualifications in KS5?	1-5 pupils	5-10 pupils		10-15 pupils	more than 15 pupils	
These next questions relate to the introduction of the new National Curriculum (2013), the removal of Food Technology from the D&T suite and what provision you are currently offering in school for Food education at KS 3, 4 and 5.						
Does your school now provide Food and Nutrition/Cooking lessons in KS3?					Yes	No

Questionnaire to gather information about the Food & Nutrition provision in secondary schools in England

Ruth Seabrook 2018 - please respond to ruth.seabrook@roehampton.ac.uk

Does the D&T department still deliver these lessons? If No, who does_____________________________?				Yes	No
Do you still have specialist rooms for Food lessons? If No why not _____________________________?				Yes	No
How many hours of teaching does D&T have across the year? (This includes Product Design, RM, ECT, Textiles and Food)	Give a number:	How much of this is Food teaching?			Give a number:
How often do pupils do practical work? (Cooking and Prep)	More than once a week	Once a week	Once a fortnight	Once a month	Other:
What sorts of food are the pupils making? (tick any that apply)	Savoury dishes	Cakes & biscuits	Snack foods	Puddings	Bread & Pastry
Are they considering the nutritional needs of those for whom they are making foods?				Yes	No
Does your school provide Food Options at KS4?				Yes	No
If Yes, what qualifications are available?	Food and Nutrition GCSE	Level1/2 Award in Food and Catering	Technical awards	V Certs	Other:
What is the take up for Food & Nutrition/Vocational Qualifications in KS4?	1-5 pupils	5-10 pupils	10-15 pupils	more than 15 pupils	
Does your school link with a local HE college to outsource this provision?				Yes	No
Do you think there should be better provision at KS4	Yes	No	At KS5?	Yes	No
Please give any comments about the food provision in your school or that is available currently at KS4/KS5.					

Appendix 2

Case Study Questions

1. Historically what food teaching was there at KS3, prior to the new National Curriculum?
   - What sort of food were cooked?
   - Any science?
   - How many hours p/y?
   - Specialist food teachers?
2. What options were available at KS4?
   - Vocational?
   - Diploma?
   - GCSE?
   - Catering?
   - Level1 or 2?
   - Take up at GCSE level?
   - What option block?
   - What were the outcomes?
3. Anything at KS5? Please give examples.
4. Exam boards chosen?
5. Since new N/C what is taught now at KS3?
   - How many hours?
   - Sorts of dishes?
   - How many hours p/y?
   - Any science?
   - Any nutrition?
   - Food specialists?
6. Since new N/C what is taught now at KS4?
   - What is the take up now at GCSE level?
   - What options are available?
   - What option block?
   - Food specialists?
   - How many staff?
7. Anything at KS5? Please give examples.
8. Do pupils pay for ingredients or does school provide?
   - At KS3?
   - At KS4?
9. Do you have technicians?
10. Examination boards chosen now?

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Chapter 5
A Technological Approach to Secondary Food Education in New Zealand

Wendy Slatter

Abstract Food unites humanity and expresses many aspects of our identity as a person. However food can signify different things depending on what era you are from, who you are and where you live in the world. One way to look at our relationship with food is by exploring how we educate about food.

In New Zealand the Health and Physical Education curriculum utilises a socio-ecological perspective, where learning about food and nutrition is used to explore factors of influence upon the well-being of individuals, families and communities. The practical components include not only selecting, preparing, cooking and serving food but also engaging students with opportunities in health promotion within their school and/or local community. Another food focus from the Technology curriculum bases food technology within a sociocultural learning theory perspective where learning experiences in food technology are to be explorative, authentic in nature, practical and transformational. Students develop material and ingredient knowledge to formulate food products that meet the needs of a specific audience. Exploration of the impact of target audiences, resources and economic constraints is undertaken to gain understandings and experiences in the development of food products.

This chapter examines the issue of food education in New Zealand, reviewing the past and exploring the current situation. This chapter then explores a theoretical model that presents food as a technological outcome. Specific reference will be made to what components of food could be taught to students at junior secondary level (12–14 years, Year Level 8–10).

Keywords Food education · New Zealand curriculum · Technological food literacy

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The Educational Origins of Food Education in New Zealand

New Zealand's educational history is rather short when compared with some other countries. The Education Act 1877 established a free, universal, compulsory education for all Pakeha New Zealand children between the ages of 7 and 13 years. Based on the English Revised Code of 1862, the compulsory nature of education only considered educating children up to standard 6 (Year 8–12 years). The Education Act 1877 specifically mentions 'girls only' sewing and needlework classes as a subject. These "principles of domestic economy" (Ewing, 1970, p. 1) lessons in standard 5 and 6 (11–12 years old) did not include cookery lessons. Provision was made for education boards to extend manual and technical instruction when the revised Act of Manual and Technical Instruction Act 1900 was passed. These regulations recognised a wider range of activities that could be taught including cookery and as a result paved the way for cookery instruction to be accepted as part of the curriculum (Ewing, 1970; Tearney, 2016). Education boards began to set up specially equipped centres with qualified instructors that nearby schools came to for 2 h a week for 30 weeks of the school year (Ewing, 1970, p. 101). However it appears that these centres operated on a gender bias, with boys attending woodwork lessons and the girls attending cookery classes.

Compulsory Home Science lessons were introduced for Form 3 and 4 girls (13–14 years old) in 1917 (Tearney, 2016) to prepare girls for their future roles as wives and mothers (Rata & Sullivan, 2009; Swarbrick, 2012). This led to a debate whether there should be the development of a generic curriculum for all secondary students or if they should be educated according to their prospective future careers. By 1929 the New Zealand Curriculum specified that in Form 1 and 2 (11–12 years old) boys should receive lessons in Woodwork and girls should receive Homecraft lessons. The now-named 'Homecraft courses' included instruction in the individual fields of cookery, housewifery and laundry work (Ewing, 1970). It appears that the name change from Home Science to Homecraft lessons followed the development of the Home Science School at the University of Otago in 1911. The Home Science School focused on a 'thoroughly scientific education for women, in the principles underlying the conduct and organisation of home life' (Boys-Smith, 1910), whereas the school-based lessons (often taught by Home Science graduates) focused on the more practical aspects of applying these principles in the home.

There is a need to focus on what was occurring in New Zealand as a society and the role it played on a global stage at this period in time. The 1920s to 1950s was a period of great change in New Zealand. This time frame spanned New Zealand's agricultural depression of the 1920s, the Great Depression of the 1930s, the Second World War 1939–1945 and the influence of the first Labour Government in New Zealand's history in power from 1935 to 1949. These events shaped the nature of New Zealand's society through to the 1980s.

New Zealand's education system developed also. Following political reviews, the recommendation that New Zealand education system introduce a common core secondary curriculum was made. New Zealand introduced a core secondary curriculum, but Homecraft was still a compulsory subject for girls only. By 1949 the Homecraft syllabus referred to lessons in cookery theory, cooking practice and housewifery. This syllabus guided teacher practice until the 1960s. Lessons were framed into units of work that concentrated on ‘the planning, preparation, and serving of well-balanced and attractive meals, and the formation of good eating habits (Ewing, 1970, p. 254). This division of the manual training education experiences by gender continued until the 1970s (Swarbrick, 2012) with boys doing woodwork and girls trained in cooking and sewing.

But another education review in New Zealand was just around the corner. Within New Zealand’s political and educational circles, concerns were being raised about the nature of the educational arena, where a centrally located Department of Education dictated how schools could operate, family involvement and teacher education (Openshaw, Lee, & Lee, 1993, p. 274). By 1987 reviews and reports by government agencies were being held, leading to big changes to the educational arena. Government offices were disestablished, schools funding models changed, governance and curriculum statements were rewritten and teacher training was overhauled (Tearney, 2016).

Curriculum Development from 1970 to 1990

The curriculum changes in New Zealand signalled a name change from Homecraft to Home Economics. This reflected a global change as a subject developed in the 1970s, moving from a space of household management, thrift and craft towards recognising the importance of relationships between individuals and the wider family context (McGregor, 1997). At the classroom level, gender distinctions in subjects were being removed in the Year 7 and 8 (11–12 years) manual training classes (Swarbrick, 2012), paving the way for the lessons experienced by gender difference to be removed. Both girls and boys were to experience food and woodwork lessons for the first time in New Zealand schools. This change had a flow on effect in secondary schools and the types of subjects being available for students to study.

In 1985 the *Syllabus for Schools Home Economics Forms 1–4* was developed (Street, 2006). This was considered the first national statement for Home Economics education. The philosophy of this syllabus identified that Home Economics education related to families, the individuals within them and the quality of their lives (Department of Education, 1985). The syllabus provided a framework that ‘scaffolded’ learning which led to the School Certificate (Forms 5–15 years), the development of Sixth Form Certificate Prescription (Forms 6–16 years) in 1986–1987 and the draft University Bursary Prescription examination guidelines which dictated the nature of Form Seven Home Economics studies for the award of a Higher School Certificate (Form 7–17 years) in 1987.

The Development of the New Zealand Curriculum (1987–2018)

There was a radical transformation of New Zealand's education sectors between 1987 and 2000. Reviews of all education systems from early childhood, primary and secondary education and tertiary level were conducted in 1987. The report findings of these reviews led to significant changes in the education sector. The structure of schools and the content of the prescriptions of learning were altered. The Department of Education which had administered all education systems, administration and teacher overview in New Zealand was abolished and replaced by a Ministry of Education which was only mandated to provide financial, property and policy advice and issues.

The learning in and about 'food' was dramatically affected by curriculum reviews. When *The NZ Curriculum Framework* (Ministry of Education, 1993) was released, the Home Economics syllabus had been deemed obsolete and was removed. The teaching of, and about, food was retained but was now present in two essential learning areas—Health and Physical Education and Technology. The Technology curriculum was released in 1995, 2 years ahead of the Health and Physical Education curriculum in 1997 (Street, 2006). However, as a result of staggering the release of syllabus support documents and teaching strategies, 'the placement of the traditional body of home economics knowledge within and across these curricula was unclear' (Street, 2006, p. 8).

Technology as a learning area in the New Zealand Curriculum aimed to develop students' technological literacy (Ministry of Education, 1995) and incorporated three strands of technological capability: (1) technological knowledge, (2) technology and (3) society (Ministry of Education, 1995). Jones (1997, p. 53) indicated that the learning about food was altered from a craft-based approach to a focus 'technology and technological practice'. However, when the Health curriculum content was released, 'aspects of Home Economics' (Ministry of Education, 1999, p. 6) were included. These aspects particularly focused on the study of nutrition and related practical food preparation. The context of food and nutrition was also used to explore factors of influence upon the well-being of individuals, families and communities (Ministry of Education, 2007). It is important to appreciate that the practical components included not only selecting, preparing, cooking and serving food but also referred to engaging students with opportunities in health promotion within their school and/or local community (Ministry of Education, 2007).

However curriculum review did not end there. A further curriculum review, *the New Zealand Curriculum Stocktake Report*, in 2001–2001 investigated how well teachers had interpreted and implemented the national curriculum of the 1990s (Ministry of Education, 2003a). These findings led to *the New Zealand Curriculum Matauranga Project* (Ministry of Education, 2003b) where the curricula were again reviewed and refined.

With the development of *the New Zealand Curriculum*, a parallel review and development of the senior secondary examination system (Years 11 to 13–15 to

17 years) was occurring at the same time. These two reviews promoted the development and repositioning of food education. Under these reviews, senior subject curricula were written and examinations for food education were developed. Prior to this, food education had struggled to be considered an academic subject (Hipkins, Conner & Neill, 2005; Ministry of Education, 2005).

When *The New Zealand Curriculum Stocktake Report* of the Health and Physical Education learning area review (Ministry of Education, 2006) was released, it was indicated that no curriculum revision for this learning area was necessary. The Food and Nutrition strand, with key learning about nutrition and practical food preparation, is still taught, underpinned by the support and understandings illustrated in the 1999 *Health and Physical Education in the New Zealand Curriculum* (Ministry of Education, 1999) document.

However, *The New Zealand Curriculum Stocktake Report* of the Technology learning area review led to the area being developed further. The three strands from the 1995 *Technology in the New Zealand Curriculum* were merged into one called Technological Practice. Two new curriculum strands were added. The Nature of Technology strand focused on the philosophy of technology to permit an enhanced critical understanding of technology (Compton & France, 2006). The other new strand, Technological Knowledge, identified key concepts in technology and technological knowledge that were generic to all technological activities (Ministry of Education, 2007). In addition to new curriculum strands, learning in technology was now categorised as occurring in three technological areas where students would learn to (1) design and develop materials outcomes, (2) design and develop processed outcomes and (3) develop design and visual communication skills. Food Technology was now termed to be a process technology where students developed the 'knowledge of the materials and ingredients used to formulate food, chemical and biotechnical products' (Ministry of Education, 2007, p. 32).

It should be noted that as these reviews have been conducted, the fundamental philosophical differences between Home Economics curriculum and the Technology curriculum were identified. However, there is still confusion about the identity and positioning of Home Economics and Food Technology within curriculum for schools and teachers (Hipkins, Conner & Neill 2005). The Health and Physical Education curriculum is founded on the concept of well-being and is underpinned by a socioecological perspective where students are to develop an awareness of the interrelationships that occur between themselves, others and society (Ministry of Education, 2007). On the other hand, the Technology curriculum is based within sociocultural learning theory (Compton & Harwood, 2003) which suggests learning should be authentic, experiential, practical and transformational.

The resulting national curriculum which comprises of *The New Zealand Curriculum* (for English medium schools) and *Te Marautanga o Aotearoa* (for Maori medium schools) was released in 2007. These curricula set the direction for schools as they design their own local-focused school curriculum but does not prescribe the content. *The New Zealand Curriculum* (Ministry of Education, 2007) was intended to be used as a resource for each learning area to guide their planning and teaching. Schools are encouraged to co-construct their own curriculum by working with their local communities to identify their core set of values from within the national curriculum framework (Ministry of Education, 2007). This links with the idea that education plays a role in changing people (United Nations Educational, Scientific and Cultural Organisation, 2007). The concept that teachers are change agents naturally follows. But to be effective in this role, teachers need to have guidance about what elements of and about food should be taught.

Food as a Technological Outcome

What follows is a discussion of a New Zealand research project *Education for Food Literacy* (Slatter, 2017) undertaken during 2010–2013 that aimed to identify the elements of food literacy and how it could be taught to develop a twenty-first century food literate person. In the initial stages of this research project a broad, encompassing definition of what food and literacy was sought, as a broad, modern definition of food which reflected the many areas of knowledge within which food now plays a role was required. The International Union of Nutritional Sciences and the World Health Policy Forum in April 2005 attempted to prepare such an broad based definition. The resulting Giessen Declaration that was developed at this meeting provides an international perspective about food to underpin subsequent studies in the field of food (Cannon & Leitzmann, 2006).

The Giessen Declaration indicates a three-dimensional perspective about food, that is, one that considers the biological, social and environmental perspectives, concerned with 'personal, population and planetary health; with the human, living and physical worlds' (Cannon & Leitzmann, 2006, p. 8). The Giessen Declaration acknowledges the historic basis of food and nutrition study in the chemical and biological sciences but moves from a narrow definition to reflect a broader base which is more reflective of how nutrition has a wide-ranging influence in the modern world (Beauman et al., 2005). This definition became a cornerstone for the research project. However the Giessen Declaration's view of food was missing a link with humanity that would make food truly reflective of a technological outcome. It was felt that this view of food could be strengthened with the addition of a technology viewpoint.

Technology is defined in its broadest sense as human activity that transforms the natural world to make it a better fit with the needs of humans (De Vries, 2005; McGinn, 1978). Pitt (2000) suggests that technology 'is humanity at work' (p. 11). Mitcham's (1994) ideas about the domain of technological knowledge suggest that technology is central to human activity. People combine both technological knowledge and technological volition to produce technological activities and technological objects in our world. Mitcham (1994) extends this view further to provide a conceptual frame within which objects can be viewed as a technological outcome. These objects are justified to exist in terms of the nature of its knowledge, its ontology and inherent activity and the volition that drove the human interaction with the object.

When the idea of food is considered within Mitcham's (1994)conceptual frame food technological knowledge is reflected and utilised in the food preparation techniques. When people make a decision to place the item in their mouths, this turns the item into food. Technological knowledge is shown when people apply knowledge to an item and prepare it for food. Mitcham's final mode of technology is volition (Mitcham, 1994). This is where people combine the technological knowledge and volition, with technological activity to produce a technological object. An ontological perspective where the decision to consume an item (in this case what we term as 'food') suggests that the food has undergone a technological process of planning, design and transformation. As a result of these processes, the food becomes a technological outcome. In the initial stages of this research, a generic model illustrated how the Giessen Declaration (Beauman et al., 2005) and the philosophy of technology (Mitcham, 1994) were developed to assist in defining technological food literacy.

Defining Technological Food Literacy

In seeking to determine a definition of technological food literacy, there was a need to identify a robust underpinning framework. The Giessen Declaration (Beauman et al., 2005), which defined how food is perceived in the modern world, and Mitcham's (1994) modes of technology that conceptualised the philosophy of technology (De Vries, 2005) were selected. These two concepts underpinned a model that was developed that sought to explain and explore ideas about technological food literacy. Key statements from the literature (Beauman et al., 2005; De Vries, 2005; Mitcham, 1994, 2001) were identified. These descriptions were used to develop an essence statement to illustrate the ideas behind each section in the theoretical model. These key phrases are indicated in Table 5.1, progressing down the left-hand column. The developed essence statement is shown in the right-hand column.

A theoretical model (shown in Fig. 5.1) was then developed. The model needed to provide space for a wide breadth of issues to be considered as well as indicate the potential for a wide choice of topics for teachers to consider when planning their programmes of learning.

Within the theoretical model (Fig. 5.1), food is seen as a system, where sets of things work together in complex and interconnecting ways. The Giessen Declaration (Beauman et al., 2005) identifies three dimensions of food systems being 'biological, social and environmental' in nature. Using this description, the theoretical food technology literacy model shows these three systems as spheres at the top, feeding into the model shown in Fig. 5.1. These indicate that these systems are specific spheres of knowledge about food.

The Giessen Declaration (Beauman et al., 2005, p. 784) also indicates that each dimension interacts with 'human, living and physical resources'. In the theoretical food technology literacy model, it is presumed that these resources can be cultivated,

Table 5.1 Essence statement descriptors for sections of the theoretical food technology literacy model, indicating source key phrases from the literature

Literature informing a theoretical food technology literacy model	Essence statement descriptors for sections of a theoretical food technology literacy model
Social systems Social interactions that influence the long-term sustenance of life on earth and happiness of humankind (Beauman et al., 2005, p. 783).	The interaction of food and food cultures with issues that affect the sustenance and happiness of humans.
Biological systems Interactions of food and nutrition with physiologic, metabolic and genomic human systems, nutritional control and prevention of diseases in human health, of both individuals and populations (Beauman et al., 2005, p. 783).	The personal and population health nutritional status that influences and affects the personal health, nutrition adequacy and well-being of people.
Environmental systems Deterioration of planetary environments—global climate change, ozone, topsoil, loss of species, chemical pollutants (Beauman et al., 2005, p. 785).	The cultivation, conservation and depletion of living and physical resources resulting from environmental and ecosystem change The influence of the food manufacturing, retail and distribution systems.
Technological activity—which comprises: Mitcham's (1994) view of technological activity considers the way in which many things 'happen' in our world and the way in which technological knowledge produces artefacts.	*Technological activity*—which comprises: How things happen in our world, which produces technological artefacts. This activity *utilises*:
Technological knowledge The knowledge and skills involved in making and using technology (Mitcham, 2001).	*Technological knowledge* Practical ideas, the making and using of artefacts *and*
Technological volition Knowledge about the physical world is used by humans to design products, processes and systems (Mitcham, 1994). These actions are related to the person's world view and are also influenced by their ethical and aesthetical decisions (De Vries, 2005).	*Technological volition* The will to do, based on a view of reality, ethics and a moral compass.
Technological artefacts Articles that transform the natural environment and that fit better with human needs, using all kinds of information and knowledge, natural and cultural resources (De Vries, 2005, p. 11).	*Technological artefacts* The food artefacts produced that influence people and populations and our planet. These may be an item or a philosophic stance.

conserved or used to sustain human life (Beauman et al., 2005). The human world suggests that resources include people's skill levels and knowledge, man-made structures and the expected life expectancy of populations (Adams et al., 2002). The living world encompasses the natural world of plants and animals and how they can be harnessed (Adams et al., 2002). The physical world includes the energy sources in the world, such as wind, wave, solar and biofuel, and the raw materials that the world might produce, such as cotton, iron ore, forestry and harvest from the sea, as well as the logistics of their supply (Adams et al., 2002). These worlds are situated inherently within the biological health and social and environmental

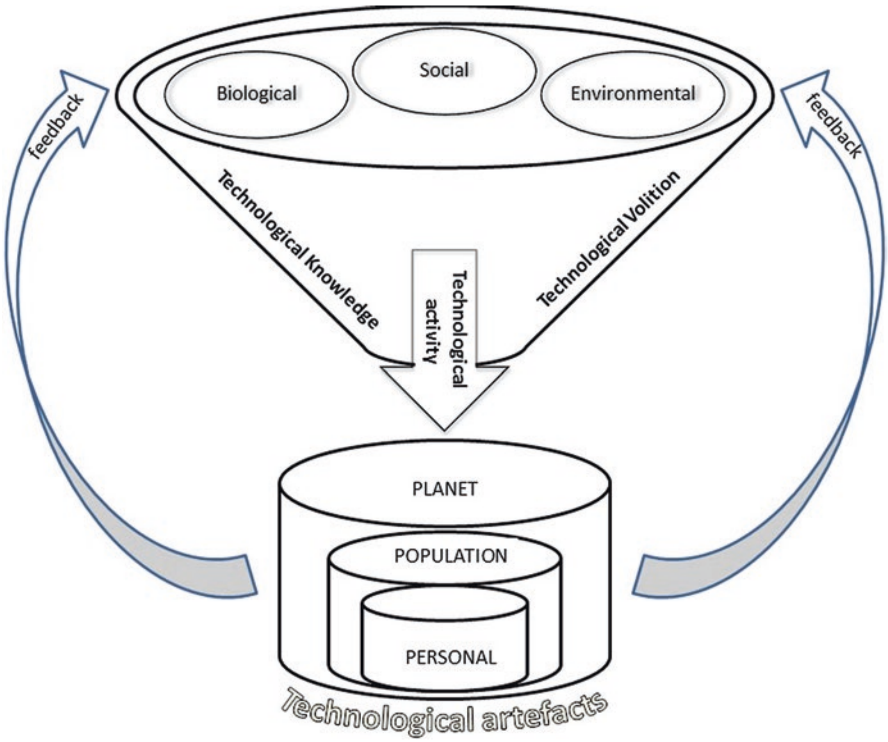


Fig. 5.1 The theoretical food technology literacy model. *Note*. The food systems and associated resources feed into the technological activity funnel, which produces technological artefacts that affect the person, populations and the planet. Feedback is also shown by the arrows

dimensions which are used as required. The worlds do not have equal and constant interrelationships with each sphere. Some spheres may have aspects of each world that interrelate in a minor way, dictated by the drive of technological activity and volition. The dominance or otherwise of each will depend on the aspect of food that is being considered and which aspect is regarded of paramount importance.

Finally, the Giessen Declaration (Beauman et al., 2005, p. 783) suggests that the ultimate concern of new nutrition science is with 'personal, population and planetary health'. This is indicated at the base of the theoretical food technology literacy model with a series of nesting containers.

It is proposed that the theoretical food technology literacy model provides a way of looking at the resources of food and their associated systems and all the constituents interacting from a technological perspective. Mitcham (1994) philosophical perspective of technology suggests that technology is central to human activity, where people combine technological knowledge and volition to produce technological activities and objects in our world. This philosophical approach provides a framework to mediate with these dimensions of food.

The rich complexity of the food world and the way humans use knowledge and volition on food systems mean that a way of clarifying the connections is required. These technological connections and interactions are represented in the theoretical food technology literacy model as two sides of the funnel in the centre of the diagram, where technological activity occurs, creating food artefacts that nest in the containers at the bottom of the diagram.

Technological activity is represented in this model by a central funnel shape. Similar to when liquids flow through a funnel, there is the potential for an infinite number of connections to be made. The funnel represents the potential that food systems and worlds can connect and touch each other. These interconnections could be fleeting or be more permanent. This activity is technological as human activity brings about the connections. The funnel is a visual metaphor for technological activity and the potential for change in the food as it tumbles through the funnel towards a technological food outcome. Shown by the nesting containers, the food outcome can affect a person or a population group or have a global influence. There is a space for feedback mechanism in the theoretical food technology literacy model. This is shown by the arrows on the sides of the diagram. These arrows acknowledge that prior action and knowledge can feed back into the theoretical food technology literacy model in a manner that might inform future activity.

The Characterisation of a Food Literate Person

The research also sought to characterise an 'ideal' food literate person from the opinions of food experts. The food experts were asked to reflect on their opinion of the personal characteristics of a food literate person. Through the use of a Delphi methodology, these opinions were reaffirmed and clarified, and convergence of expert opinion was gained. The Delphi methodology is a way to structure a group communication where, over the series of sequenced rounds, a consensus of opinion is gained (Linstone & Turoff, 1975).

Initially, it was important to discover if the views of the food experts matched with the ideas of the theoretical frame as this progressed the theoretical ideas towards a conceptual frame that articulated what food literacy could look like and what components could contribute to this idea. A synergy was achieved by using the key phrases in the essence statement descriptors (right-hand column of Table 5.1) with the phrases used by the food experts as the Delphi rounds progressed. The phrases were coded in this way as this helped to illustrate what the experts felt the components of technological food literacy could be and where they were located within the theoretical food technology literacy model. A generic example of this analysis is shown in Fig. 5.2. The first Giessen dimension of social dimension within this framework is used as an illustration in this figure. The essence statements progress down the left side of the analysis framework. Each dimension was colour coded because the expert's ideas do not sit neatly within one area of the model but

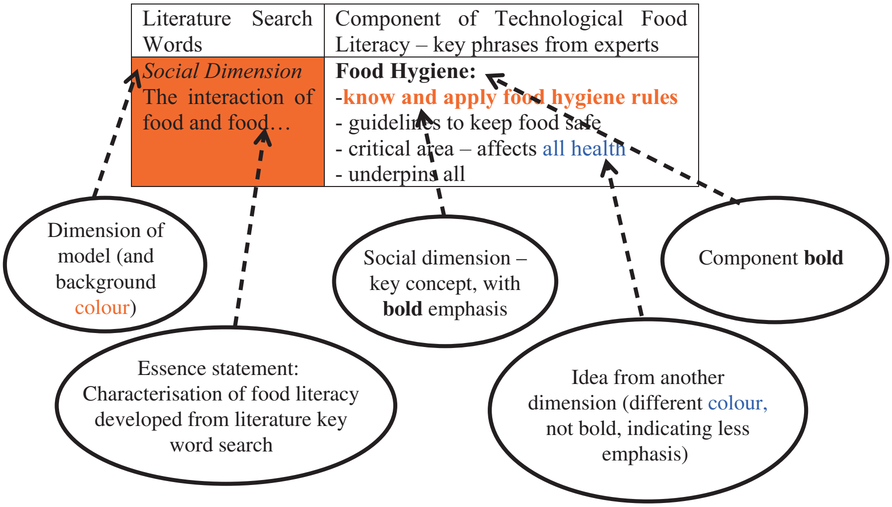


Fig. 5.2 The analytic tool—a generic example—moving from the theoretical to a populated food technology literacy model

can be integrated across different dimensions. When the food experts' ideas about food had a greater emphasis, the idea was shown in **bold-**coloured typeface.

Literature search words	Component of technological food literacy—key phrases from experts
Social dimension The interaction of food and food	Food hygiene – *Know and apply food hygiene rules* – Guidelines to keep food safe – Critical area—affects all health – Underpins all

This analysis determined the components of technological food literacy placement within the populated food technology literacy model. Ideas about the content of each component of food literacy as expressed by the food experts were considered and then overlaid with the ideas expressed in the literature about food and technology. These are indicated in Table 5.2.

The initial development of the theoretical food technology literacy model considered the information contained within the Giessen Declaration (Beauman et al., 2005) and Mitcham's (1994) philosophical viewpoints about technology. The ideas of food experts were then explored to see if they could populate the theoretical food technology literacy model.

The populated food technology literacy model in Fig. 5.3 indicates where the expert-originated components of technological food literacy have been located within the theoretical food technology literacy model. Abbreviations have been used to make the diagram easier to read.

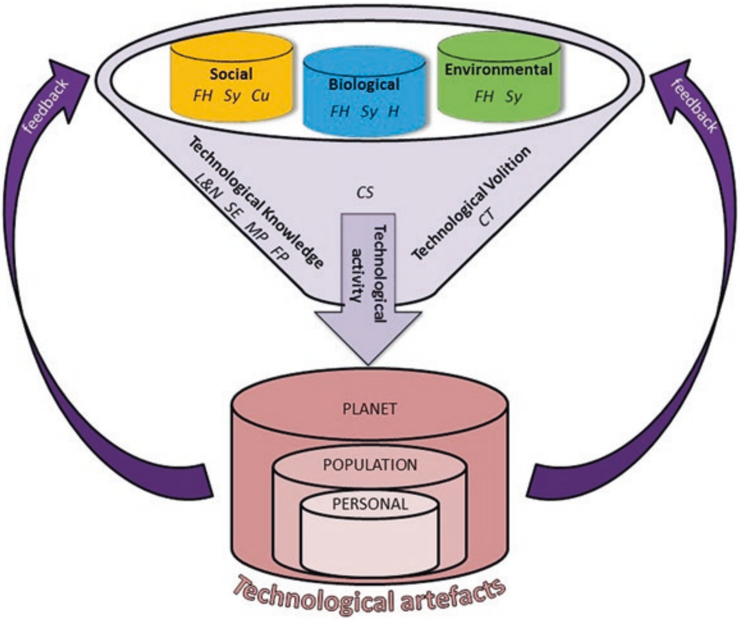
Table 5.2 Populating the populated food technology literacy model—with key phrases from the experts (Giessen and Mitcham) that align with essence statements that have been informed from literature

Essence Statement Descriptors for Sections of the Food Technology Literacy Model.	Components of Technological Food Literacy – Key Phrases from Experts
Social Dimension The interaction of food and food cultures with issues that affect the sustenance and happiness of humans.	**Food Hygiene:** **Know and apply food hygiene rules** Guidelines to keep food safe Critical area – affects all health Underpins all of us **Cultural dimension and significance of food:** **Roles and rituals with food** **A way cultural groups communicate** Sense of purpose to food There's more to food than just eating it **Systems that underpin food:** Marketing Food packaging Food labels Know what is in your food before you eat it Preservation of food
Biological Dimension The personal and population health nutritional status that influences and affects the personal health, nutrition adequacy and well-being of people.	**Food Hygiene:** Cross-contamination Food supply contamination **Health:** **What gives health in food and what doesn't** Healthy eating patterns Healthy lifestyles Health problems Managing our food intake **Systems that underpin food:** Additives Food processing
Environmental Dimension The cultivation, conservation and depletion of living and physical resources resulting from environmental and ecosystem change. The influence of the food manufacturing, retail and distribution systems.	**Systems that underpin food:** Growing Distribution Retail Production

(continued)

Table 5.2 (continued)

Essence Statement Descriptors for Sections of the Food Technology Literacy Model.	**Components of Technological Food Literacy – Key Phrases from Experts**
Technological Activity – which comprises … How things happen in our world which produces technological artefacts. This activity *utilises* …	**Cookery skills:** **Applying cooking skills to food** Skills for basic food preparation Skills practised and competency gained
Technological Knowledge Practical ideas, the making and using of food artefacts *and*	**Use of literacy and numeracy skills:** Have basic literacy and numeracy skills Read food labels Interpret recipes **Understand how to apply skills to food** **Sensory experience of food:** **Know how food should taste** Food is a nutrition and a sensory experience Develop tastes at a young age Know about ingredients and flavours **Menu planning and food purchasing decisions:** Shopping skills to purchase “good” food Budget skills learned **Essential basic skill** Used for health management How to spend money **Food preparation from scratch:** Innovation Trying new things Authentic situations Learn about ingredient action by doing
Technological Volition The will to do, based on a view of reality, ethics, moral compass, world view.	**Critical thinking and decision-making about food:** Wide and deep thinking Making decisions Acting on decisions How to make “right choices” about food Innovation fostered and products developed



Key of Abbreviations for the Components of Food Literacy Shown on the Populated Food Technology Literacy Model

FH	Food hygiene	CS	Application of cookery skills
FP	Food preparation from scratch	L&N	Use of literacy and numeracy skills
SE	Sensory experience of food	Cu	Cultural dimension and significance of food
Sy	Systems that underpin food	CT	Critical thinking and decision-making about food
MP	Menu planning and food purchasing decisions	H	Health-giving properties of food

Fig. 5.3 The populated food technology literacy model

Key of abbreviations for the components of food literacy shown on the populated food technology literacy model

FH	Food hygiene	CS	Application of cookery skills
FP	Food preparation from scratch	L&N	Use of literacy and numeracy skills
SE	Sensory experience of food	Cu	Cultural dimension and significance of food
Sy	Systems that underpin food	CT	Critical thinking and decision-making about food
MP	Menu planning and food purchasing decisions	H	Health-giving properties of food

Discussion

This chapter reviews the history and location of food within the New Zealand educational landscape. There is clear evidence that food education has been present in various forms in New Zealand's educational history. The recent development of *The New Zealand Curriculum* (Ministry of Education, 2007) locates food education within two learning areas, with different underpinning learning theories, structure and focus. Food lessons are no longer about teaching cookery skill and housewifery. The Health and Physical Education curriculum scaffolds learning in food and nutrition by exploring factors of influence that affect the well-being of individuals, families and communities. The practical components include selecting, preparing, cooking and serving food. Students are also engaged with health promotion within their school and/or local community. The Technology curriculum bases food technology within a sociocultural learning theory perspective where learning explores authentic issues that aim to be practical and transformative to the situation and people concerned. Students then develop material and ingredient knowledge to formulate food products that meet the needs of this specific audience. Exploration of the impact of target audiences as well as the resources available and the economic constraints helps to gain understanding and influence experiences in the development of food products.

The *Education for Food Literacy* research project focused on the development of a model that sought to support food education teachers, particularly from a view that explored developing a student's technological food literacy. Initially a theoretical model was developed from the perspective that food is a technological outcome. This model was framed by idea of new nutrition science expressed in the Giessen Declaration (Beauman et al., 2005) and structured by the modes within the philosophy of technology (Mitcham, 1994).

Food experts were then approached to identify what would epitomise a twenty-first century food literate person. By combining their viewpoints and the theoretical model, it became clearer for food teachers to identify what aspects of their specialist disciplinary knowledge could be combined in a food technology programme. The next stage of this project involved food teachers in New Zealand discussing and planning how the components of food literacy linked with *The New Zealand Curriculum*. It became apparent that teaching food literacy reflects a deeper pedagogy than just teaching cookery skill. As New Zealand food education programmes are developed at a school level, the components are being used to inform teacher decisions about the context, concepts, content and focus for their food technology programmes.

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Chapter 6
Developments in Secondary Food Education in England Since the 1970s: A Personal Perspective

Angela J. Turner

Abstract Food education is engaging and essential for good health and provides the grounding for jobs and careers in one of the UK's largest industries. This chapter explores my experience of food education in English schools and how it has evolved from domestic science in the 1970s through being part of design and technology (D&T) in the national curriculum to more recent trends where the subject has separated from D&T with the introduction of General Certificate of Education (GCSE) Food Preparation and Nutrition for pupils aged 14–16 years. It is a personal tale drawing on my experiences as a pupil, as a graduate in the food industry and as a teacher working in and around London for more than 25 years. Food is intrinsically woven into our culture and our daily lives that we cannot consign it to 'just another school subject' but should elevate its standing in school where we are taught the basics in a way that helps us to understand the world around us and to have healthy relationships with the food we eat. We cannot leave this education to celebrity chefs—they enhance the basic school curriculum, not replace it. A good education in food should be high profile and valued for its contribution to a healthy society and to a well-educated workforce; I wonder if we have achieved this ideal?

Keywords Food technology · Design and technology · Food education · Curriculum · Society · Food industry

Introduction: Purpose and Validity of Food Education

'Magic things happen when you cook…' Asher (1990, p. 7) sums up the exciting subject that I have been learning all my life and teaching for half of it. She goes on to say that 'the combination of one food with another can dramatically alter the

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flavour of them both; sauces thicken, dough rises, sugar caramelises. The first time you experience one of these miracles is very exciting…'

Food education is engaging and essential for good health and provides the grounding for food-related jobs and careers.

Children are taught to make food products: basic skills of chopping and cutting, mixing ingredients and cooking in a variety of ways with outcomes which they can share with friends and family. An interest in food is fashionable, with the rise in celebrity chefs, social media for sharing ideas and TV cooking competitions. Children bring these trends into school, and our curriculum is exciting when it offers the fun depicted in the media. I wonder if we always allow this to happen?

The food choices we make affect our physical and mental health. The many factors affecting this choice can become confusing; we do not always make the best decisions. Public Health England (2017) states that we live in an obesogenic environment where our default choice is for foods which are less than healthy. The statistics for childhood obesity make shocking reading with 28% of children aged 2–15 being overweight or obese and 'younger generations become obese at earlier ages and stay obese for longer'. There are government strategies to combat the rise of obesity, for example, the sugar tax; after all, it is essential that the population is healthy to be economically active and to reduce the strain on the National Health Service (NHS). What we teach in school is an essential part of learning about how to be healthy, not just the explicit curriculum but those aspects of the hidden curriculum covered by the School Food Plan (http://www.schoolfoodplan.com/) and Healthy Schools Initiative (https://www.healthyschools.org.uk/).

An increasing number of our students will work in food-related careers, from nutritionists to sous chefs, food scientists and head chefs, to exploring new ways to source a sustainable supply of food or to market traditional ideas. PricewaterhouseCoopers (2017) states that between 1989 and 2015, the number of people who said they eat out more than once a fortnight rose from 10% to 41%. The biggest growth in manufacturing is in the food industry; UK food and drink manufacturing employs 418,000 people with a prediction that 133,000 more jobs will be needed in food manufacturing before 2024 (Tasty Careers, 2019). As teachers, we can introduce students to this interesting and essential industry.

It is not my intention to explore the causes or cures for obesity, nor do I want to spend time promoting food-related careers, but these are issues that form a background to what we teach. The skills of 'making' form the heart of our curriculum and offer children a chance to work together and share food cultures in a more relaxed way than a traditional, classroom environment. These aspects make the subject fun to teach and fun to learn, and we should make use of this as we challenge our students to aim high and make a positive contribution to school statistics.

This chapter explores my experience of food education in English schools and how it has evolved from domestic science in the 1970s through being part of design and technology (D&T) in the National Curriculum (NC) to more recent trends where the subject has separated from D&T with the introduction of GCSE Food Preparation and Nutrition (FP&N). It is a personal tale drawing on my experiences as a pupil, as a graduate in the food industry and as a teacher working in and around London for more than 25 years.

My Own Schooling in the 1970s

When I was at secondary school in the 1970s my home economics lessons followed a familiar and safe format; we watched the teacher make something, we took notes and made it the next lesson. We were taught nutrition, food safety and about types of ingredients.

I learnt so much from these lessons, systematically going through the traditional English types of recipe, all the pastries, all the cakes, types of sauce and how to use them, not a chilli or a clove of garlic in sight. By the time I was doing advanced (A) Level (16–18 years), there was a great food science section; how do we know what happens in foods if we don't learn about the science behind it? Exactly those miracles that Asher (1990) refers to. We didn't need to be taught about seasonal foods and about the source of foods; our families were still growing vegetables in the 1970s, and it wasn't possible to buy foods out of season. Strawberries at Christmas? Of course not, they are a summer fruit.

We were mostly white children for whom the messages at school mirrored what we were taught at home. I grew up in suburban Surrey, and my classmates ranged from those on limited family budgets to those whose parents worked in the city and for whom it would be normal to have dinner parties at the weekend. It was perhaps the heyday of comprehensive education; we all went to our local school so a great social and academic mix. Ordinary (0) Level examinations for 14–16 years olds were well established, and the NC and GCSEs were not even on the horizon, an easy time to be teaching for many reasons; my school was at least an easy place socially to teach.

Alongside A Level domestic science, I also studied biology and chemistry, so I guess it was inevitable that I would take a food science degree. I didn't know anybody who worked in the food industry, but I was aware of research jobs, not least because of the testing laboratories in our town, packaging as well as food research but no food manufacturing. I happened upon the food science degree leafing through the Universities Central Council on Admissions (UCCA) handbook. And I am very glad that I did. The 1980s was a time of great change in England, especially for the way we source our food for the day. I was in the sixth form (16–18 years) when the first McDonalds opened locally; it was rare for people to eat out, and my family's experience of that would be eating fish and chips on a trip to the seaside.

Was this curriculum fit for purpose, i.e. engaging, promoting a healthy relationship with food and pointing the way to progression for the future? Probably, it taught me about food, how to make good choices and how to be safe. And in no way did it challenge what I was brought up to believe within my family. I neglected to mention that if I had been a boy then I would not have studied food; I would have been in the workshops making things from metal and wood. My secondary education in food was about being able to provide food for my family when I became an adult but also so much more than that. It opened a world beyond school that combined my interests with career options.

My Experience of University and the Food Industry

Both the content and style of teaching at university were quite different to anything I had experienced before. As a science subject, we had lectures and tutorials, lab work, independent research and the most specialist aspect, working in small-scale manufacturing to make cheese, heat treat milk and freeze-dry orange juice. I was totally fascinated by it; it was fun and certainly gave me a foundation for a career in the food industry. There was no development of the life skills aspect of school home economics, but I didn't expect this for my degree course. Not many of my contemporaries had studied A Level domestic science, and I think that initially they were disadvantaged. Part of my course was to spend time in food production, and I worked at Loseley Dairy for 3 months making ice cream, yoghurts, cottage cheese and frozen desserts as well as processing milk. We had visits to food factories, for example, Haverhill Meat Products, where the live pigs enter at one point and are processed to joints of meat and meat pies; United Biscuits, Mars and a canning company, to see the process for baked beans, all of which helped us to apply the theory of manufacturing to real life and of course deepen my understanding for the new subject of D&T when I became a teacher.

After graduating, I worked for Trebor, the sweet company, as a product development technologist, working on long-term projects where a gap in the market was identified through market research, for example, aerated products, to meet the need for lighter sweets and to sell air—way more profitable! And short-term projects to develop and improve existing products; improvements to the Maynards' wine gum flavours, trying to make the texture of tropical pastilles like a competitor's version. I worked with a Dutch company to explore products that could be bought for a wrapped pick 'n' mix line and carried out trials on a new pilot-scale jelly cooker for the refurbished research and development (R&D) lab. The reason for talking about this is the link to my teaching. Never, during my degree and in all the time I worked for Trebor, did anyone refer to the design process although we were using it. We worked in teams with people from market research and marketing, research and development (R&D) and quality control and with factory staff. We tried and tested everything we did, so it was essential to have good communication and to understand how parts of the work linked. Feedback from market research was used to change the recipes; we would do factory trials, often at 6 am before they started for the day, and get feedback from the people on the production line about how the ideas might work in practice. This constant checking and modifying was one of the most important aspects of the work which I bring out to my pupils. My understanding of industrial practice is very good because it was my day-to-day practice and we were, of course, using an iterative design process.

In terms of developing my understanding of food, and aspects of this to take into teaching, the predominant learning for me was how to make food products on a large scale, about how teams of specialists work together over a period of years to understand the science of a product, how it appeals to customers and how to formulate the recipe so that it will last for a long time and make a profit. After a few years, I wanted more; my friends had taken time out to travel, and I was getting bored of using the same process to explore new ideas. I was taught to deliver training at Trebor and found that I was good at it, so I applied for Postgraduate Certificate in Education (PGCE) to become a teacher, mostly because I wanted to feel secure when I was travelling that I had something to return to. Never did I think that I would make teaching my almost lifelong career. And one of the reasons for this is the change that had happened since I left school. Everything was now about food technology with its link to industry and to catering. I was clearly well qualified and experienced to teach this 'new' subject and was something of a rarity at the beginning of the National Curriculum years.

My First Year of Teaching and the National Curriculum

My first year of teaching in 1990 was at Kidbrooke School in Greenwich, the first purpose built comprehensive school in London, originally for girls and described in the 1950s as having "the domestic science section, which had all of the model appliances the girls would encounter when they ran their own homes…fully-furnished mock 'flats' in which the girls could practice their homemaking skills" (Cornelius, 2015). I suspect that in 1954 when the school opened this was very advanced and impressive to the parents who would send their girls there. So perhaps the same thinking was evident 40 years later when the school had chosen to be part of a Key Stage 3 Pilot for pupils aged 11–16 years for the new subject of technology.

The focus on industry was great; I had a degree in food science with a focus on the food industry, and I had worked for a food manufacturing company and was excited about the updating of a subject that was my passion. This is where I was learning to be a teacher, not an easy place to work for many reasons and no long-established plans and resources to work from. I had no idea what I was teaching. The assessment was so process based, with no clear content to either teach or assess, and I was lost! I really cannot say with any certainty that the students I taught that year had any fun, nor did they learn life skills and no explicit teaching about catering or manufacturing. In fact, my lessons did not have much that we would be recognised as food teachers, but nonetheless I embraced it and became part of the technology faculty trying to match the term 'structures' to the food curriculum by doing things which now seem crazy such as pie cases and how they support the filling inside.

I don't think that it was hard for me because I was a new teacher; I think it was hard for everyone. Did they have training to support this change? Not really. Did they like the change? I'm not sure but they were trying hard to do the right things, to be professional in their work and to follow the government direction. There were massive school-wide changes, added to which teaching a shared program of study for a diverse set of subjects was a difficult idea. Technology in the National Curriculum (Department of Education and Science (DES), 1990) provided us with a programme to follow, to plan our lessons from and to use for assessment of students' progress. I look back at it now through the eyes of an experienced teacher and am stuck—what should I teach? There is no mention of specific content which is all based around a 'design process' which could be taught and assessed through the medium of any of the subjects, this being a deliberate decision to view the subject holistically. The idea was for pupils to find the knowledge as they needed it. Over time teachers planned specific content into schemes of work which was even supported by a publication from the Design and Technology Association (2013) to show progression, but initially the focus was on process.

Who Unified the Message for a Diverse Group of Subjects?

The national curriculum for technology (DES, 1990) was a very broad subject that brought together differing disciplines of art and design, craft design and technology (CDT), home economics, business studies and information technology (IT), designed to provide a unified approach to subject content and based on the process used for designing and making rather than traditional content about materials being used.

Kimbell and Stables (2001, p. 179) describe the deliberate exclusion of content to be taught in a positive way saying that 'we emphasise the need for students to acquire and create new, task-related knowledge'. Their vision was that students would be working on design tasks and research knowledge as they needed it. This is sound thinking at sixth form (16–18 years) and degree level, and in the same way that co-construction educationalists will support students discovering for themselves and together, it comes from people who were taught knowledge and taught to memorise it so that it was to hand when needed. For me, I don't think that it works at secondary level.

From the advent of the NC in 1990 (DES, 1990) to the reform of GCSE examinations (DfE, 2015) https://www.gov.uk/government/publications/get-the-facts-gcse-and-a-level-reform/get-the-facts-gcse-reform, the community of D&T teachers worked hard to understand and establish this new subject and maintain its position in the school curriculum. The coming together of what, on paper, appeared to be a wide range of diverse subjects was dominated by craft design and technology (CDT) and home economics; with subject associations Design and Technology Association (DATA) and National Association of Teachers of Home Economics (NATHE) respectively; both aiming to develop the subjects through supporting a community of teachers with research and sharing good practice to raise standards.

NATHE joined with the Design and Technology Association, the professional association for teachers of design and technology, including food, textiles and product design, in 2000, to form a professional body to represent those involved in food education (The National Association of Teachers of Home Economic and Technology Sheffield and District Branch, n.d.). This gave a central focus for subject development and sent a strong message to teachers about working together. I have always thought that to have one, central teachers' association for our subject is a strong point; in fact even the National Association of Advisers and Inspectors of Design and Technology (NAAIDT) became part of DATA in 2013 (NAAIDT, 2013). DATA became the Design and Technology Association and promoted the view that D&T was at the centre of the curriculum and could teach students aspects of many other subjects, to be collaborative problem-solvers and to be ready to face the ever-changing world in the twenty-first century. What was missing? An understanding about what was happening in classrooms at that time. Teachers needed to have more concrete aims, were surrounded by equipment to make things, had experience of teaching craft skills and were faced with children eager to take something home. There was no clarity about the unique selling point (USP); that in our subject we make things.

The history of the development of D&T has been well documented, so I am going to pick out some of the key issues for food education rather than provide yet another factual account of what happened between the advent of the NC and the revision of the GCSE examinations and how they affected me as a teacher and the children I taught.

Did Food Flourish Within D&T or Was There Just Too Much to Teach?

Society and culture have been major drivers for change in the D&T curriculum, especially food technology, so how did we ensure that it flourished within the overall D&T curriculum and become a valued part of it?

There are many reasons for including food in the D&T curriculum; it's popular, cheap (after the initial start-up costs), quick to make a complete product and even quicker to make and test parts of products. It's fun to teach and fun to learn, results are usually eaten and very quickly forgotten but real lessons are learned, it offers great opportunities for collaborative working and sharing of results and it's easy to do mass production activities.

As a food teacher who had a background in the food industry and was brought up to believe that girls should do more than become housewives, I was excited by a curriculum that meant I could focus on food produced in catering outlets, factories and the home. The government invests a lot in understanding the nations' diet, and the recurring message is that obesity and related conditions are rising, so an important part of developing our food curriculum is to look at all situations in which we eat and teach the most important message of balance.

We become experts in food from an early age in a way that we don't with the other materials; we are emotionally and physically involved with food. Pupils' experience varies from one boy in my Year 10 (aged 14 years) class who takes turns at cooking the family meal to those who are not allowed into the kitchen. These pupils are often scared to turn on the ovens, have little manual dexterity and are quite inflexible about certain things such as weighing to the exact gram or cooking for the exact time stated in the recipe without having a feel for the product they are making.

I enjoy planning the variety of food technology projects, focusing on being creative, as a celebrity chef idea in one project and the strict factory production in the next. It could be exploring how cultures and traditions affect the food we eat or the need to observe healthy eating guidelines. The other unique aspect is that the ingredients used change completely during making, and it is in this aspect that I would promote more than any other. Pupils need to use ingredients and try things out in different proportions and with different processes to see the effects of the changes they are making. It's when they do this that they are really designing with food and get to appreciate the miracles that happen, and of course we teach them to understand the science behind it.

During this time (from 1989 to mid-2000s), I don't believe there was a strong central understanding of what outstanding food technology looked like at Key Stage 3 (11–14 years) and the variety of GCSEs available from D&T: food technology to home economics and catering created diversity at Key Stage 4 (14–16 years). There was too much to teach with some teachers focusing on good food education and others on good D&T, but it was, I think, impossible to do both. My focus was on food as part of D&T, and as a head of department, I worked hard to promote all materials. I suspect that Richard Kimbell and the Design and Technology Association would say that this diversity is a strength of D&T, but we are working in an environment where an element of control and rigour are needed; how much will the unit cost? What materials do we need to order? What are the learning objectives for the lessons? How will we assess the work and measure progress?

Rotation Courses Play to Teachers' Strengths, But Do They Hamper Pupil Progression?

A rotation system is often used to manage the variety of subjects where students study a different material each half term, taught by the specialist teacher. Davies and Steeg (2005) discuss the concerns about this rotation system and the negative effects on the quality of teaching and learning. The design process ties the subject together, but my frustration was with teachers who would expect students to know how to research or how to draw ideas or how to carry out an evaluation and not understand the need to explicitly teach them how to do it. My own experience is that such a system narrows the curriculum, rotational courses were designed to be easy for the teacher but spelled disaster for progression of the students, teachers do not invest time in building relationships with their students and they do not invest time in understanding the bigger picture of D&T or the wider team of teachers.

One school where I worked planned the explicit teaching of process statements which became more challenging over the year rather than being attached to the material area. I loved teaching at that time; I was full of energy, enthusiasm and ambition. We had fun working as a team at this school, and we had support from the local authority subject advisor in the form of Richard Green who went on to become chief education officer (CEO) of DATA and links to business enterprise advisors. One of the reasons that this chapter is told from such a personal viewpoint is that, far from being a national experience, D&T developed into a subject that depended on people's own personal view of what to teach and how.

The rotation system leads to a lack of rigour and challenge; students want to do well and to achieve the highest grades and something vital was lost in our subject as GCSE entries declined. And how did this decline affect food education and food teachers? Many carried on teaching what they had always taught, many like me tried hard to work food into the D&T curriculum and then there were the new teachers, who are employed to teach D&T with little or no training in food and therefore fell back on packaging and graphics at the expense of working with food as a material, or they were former caterers who taught sound food education, especially making but little, if any, of the design process. Clearly this situation could not continue.

The Impact of the Document Food Technology in Secondary Schools Report (Office for Standards in Education (Ofsted), 2006)

This document was a review carried out because of concerns about food technology and whether it was contributing to pupils' understanding of healthy eating. Anecdotal evidence pointed to issues around the content of lessons being too focused on D&T written work and not enough on teaching children how to cook. Teachers found it hard to teach food both as a life skill of cooking and as a material with which to design; if we were trying to do both, there simply was not enough time in the curriculum. It pointed to great variation between schools and concluded that one of the most important things was the need to clarify the nature of food technology as a subject.

I have been a firm advocate for food being part of D&T; after all, the food industry and chefs follow the design process, and my own qualifications and experience fit well with being a D&T teacher. Ofsted (2006, p. 6) was pretty damning, at one point quoting how family's and teacher's values for the subject clashed, with the comment from one Year 9 girl 'I know what my dad will say: "I'm not eating that rubbish, give it to the dog"'. It probably sparked the beginning of the separation of food and D&T. It managed to find the worst examples of food being taught by non-food specialists with too much emphasis on things like drawing food ideas, even using computer-aided design (CAD) packages, playing to the strengths of the teacher and not to the needs of the students or to the teaching of sound food-related content or skills.

One outcome was the 'Licence to Cook' initiative (Food a Fact of Life (n.d.) https://www.foodafactoflife.org.uk/11-14-years/cooking/licence-to-cook/ which ran from 2007 to 2011 and was viewed by many as permission to move away from D&T and focus purely on life skills and cooking. Its aim was to provide 16 hours of practical cooking experience to all secondary pupils but not necessarily as part of the D&T curriculum. Also, at that time, the National Strategies (DfE, 2011) were playing a big part in how schools were changing.

I worked as a consultant for the local authority of Bromley from 2002 to 2011 supporting teachers to use the National Strategy materials. This work took me away from teaching, but I was involved in writing and promoting the framework of objectives for D&T (DfES, 2004). This was process based and still did not address the need to clarify content for each material area; teaching of *design* was not as good as that of *making*, so the objectives and support focused on the explicit teaching of design, thus addressing one of my own frustrations. Whilst this work was essential for D&T, it did nothing to address the ongoing issues of food education, but curriculum reforms were on the horizon.

In 2011, I returned to teaching as a subject leader for D&T at an inner London comprehensive. In the years I had been away from the classroom, things moved on; food and textiles and workshop-based D&T were more separate than ever with most teachers holding firmly to their own specialisms. The teaching of design skills had become more explicit, and we had a shared language for how to teach these. The D&T Association was still arguing that D&T is at the centre of the curriculum with transferrable, process-based skills, but I believe this thinking was redundant; it is not *what* is being taught but *how* that teaches students those skills. Ofsted, and therefore senior leaders, focused on lesson planning, on clear aims for lessons and how we were giving feedback to students against those aims, on clear and measurable outcomes and of course on how students were being engaged and how they were making progress. A geography teacher teaches collaboration and analysis during field work, a drama teacher will teach evaluation skills in relation to performance and an English teacher develops pupils' creativity. But other subjects recognise that this is not the subject but the vehicle for learning and an excellent by-product in terms of outcome. Spielman (2018) picked up this point when she recognised the opportunities for cross-curricular work, but we still need 'clarity about what your D&T curriculum really encompasses'.

The most recent revision for the D&T national curriculum for pupils aged 5–14 years (DfE, 2013) includes a cooking and nutrition section, within D&T. Food should still be taught as a D&T material, but the amount to be taught is large, so we focus on cooking and nutrition—relishing the clarity and having clear pointers to build progression across the key stage. Typically, food lessons will be given a third of D&T curriculum time in each of the KS3 years so not much with which to build a body of knowledge and skills. I constantly remind myself that there is not enough time to do everything listed in the programme of study (PoS) or to pick up every initiative and exciting idea, but we decide what to teach and do it very well. After all, the pupils use the experiences from 11 to 14 years to make decisions about choices at 14–16 years, and where we were once popular, the falling numbers and poor performance in examinations would seem to suggest that the subject was losing its place. Statistics from Joint Council for Qualifications (2019) https://www.jcq.org.uk/examination-results/gcses show a fall in entries for D&T (all specifications) from over 370,000 in 2006 to fewer than 166,000 in 2017. Now that food is a separate GCSE, our figures are positive; just less than 50,000 pupils took the new

GCSE in both 2018 and 2019. The reformed D&T seems to have fared less well with a drop to just over 127,000 in 2018 and less than 100,000 entries for 2019. My experience is that students want to do well, and they recognise the importance of their results in gaining entry to work and to further qualifications; it is not enough for a subject to be fun; as teachers, we must know what our subject is and challenge students to achieve the highest grades.

In 2016, we started to teach the reformed GCSE Food Preparation and Nutrition which I love even though all reference to D&T has been removed. The specification includes aspects of food science, nutrition, food provenance as well as high level cooking skills. Students are assessed on their ability to plan, carry out and analyse the results of a science-based food investigation. There is a theory paper which tests pupils recall, their ability to interpret information and to evaluate issues from various points of view. The third assessment is, for me, still a D&T style activity where pupils make three dishes in 3 h. The investigations do have a link to 'making' as the final part is an evaluation where the students need to discuss how they would make use of their findings in cooking specific dishes. They are tested on their ability to plan, to modify existing recipes or to be creative with their own ideas as well as evaluating the results. In the foreword of Fehners (2016), Heston Blumenthal refers to people who can cook as 'magicians' and how the kitchen is like an alchemist's lab. This understanding of the science behind the cooking allows us to challenge our students. Coe (2013) states that 'learning happens when people have to think hard'. I have been inspired by many people in my life and am motivated to keep learning and to challenge students in my subject to 'think hard'. I will never be satisfied that the purpose of my curriculum is just about cooking as a 'life skill'. The new GCSE has renewed my optimism that we can teach students strong core aspects of food education in a way that challenges their thinking as well as their physical skills and that we can compete with all subjects to increase our entries and our results.

So where are we now? Have we come full circle to a point where I am teaching what I originally signed up to? I think that the idea of modernising the traditional craft subjects under the same banner was a sound idea, but I do not think that this has worked out in practice. Spielman (2018) emphasises this point when she refers to food, design and textiles and how there is 'not a great deal of point trying to make this into a seamless whole'—we need to be sure what the D&T curriculum is about. We have not regressed but been involved in a 30-year iterative design project to determine what this new subject should look like, and regrettably it is no longer one subject.

Where Are We Now and Where Do We Want to Be?

The networks we make are such a vital part of our role; I have benefitted from and contributed to DATA projects and local networks as a teacher and continue to be challenged and inspired by other teachers. I wonder what the future holds for central support for our subject. Hardy (2015) in her discussion about the reasons for the drop in GCSE entries describes the new GCSE Food Preparation and Nutrition as being 'taught as a life skill' and compares this to the new GCSE D&T which 'will also be an essential qualification for careers and work-related skills, not just life skills'. The keywords here are life skill versus essential qualification. She seems to be undervaluing the food GCSE. And what of central support for food teachers which appears to have been removed from DATAs remit? The only national support I can find now is the Food Teachers' Centre (2019), a self-help group formed in 2013, but I am not a fan of social media, so I do not access or contribute to their closed Facebook group. I receive regular email updates and am shocked by their 'Tunnocks Tea Cake Challenge' https://foodteacherscentre.co.uk/tunnocks-teacake-challenge/ which is an inauthentic idea to teach food styling. We would never serve that product on a plate and decorate it; it is very high in saturated fat and sugar providing, in just one biscuit, 13 and 10%, respectively, of our recommended daily intakes (RDIs) (Thomas Tunnock Ltd 2018). On the other hand, the FTC promotes the 'Love Food Love Science' website https://www.ifst.org/lovefoodlovescience which, provided by the Institute of Food Science and Technology, has great resources for the food investigation aspects of the new GCSE. We are in, yet another, time of change, and as a community of teachers, we must continue to challenge ourselves and our students to be the best, with a clear understanding about what this means.

Parents' expectations for subjects have a strong influence on their children. Parents love to talk about the subject as cooking or home economics and remember what they did at school either fondly or with horror. During last October's open evenings, I had many parents asking, for the first time, if food was an integral part of the curriculum or an after-school club. It appears that many local schools offer after-school clubs, and a quick look at their websites shows that it is rare, in that part of West London, for schools to offer a GCSE Food course. Parents were delighted that it was an important part of that school's curriculum. The students love cooking, and they see their families cooking at home, few of which used ready-made meals. Several family members work in or own restaurants, and they value the contribution that my lessons made to this overall picture of their food education.

Being a teacher of food is sometimes a difficult job; everyone's an expert, and in a mixed population of students, it would make perfect sense to some that we teach about locally produced organic foods; for others, the prohibitive cost of this would make the lesson seem crazy and far removed from their own lives. Teaching about dietary guidelines is hard when parents are telling their children that low-carb diets are important and that we need sugar to give us energy, but has it always been this hard? The students' families will have ways to do things, and they read and watch so much about food in the media that it is hard to break down the misconceptions. One key aspect of this for me is washing chicken—the students in my current class are scandalised that we don't wash chicken. They go to great lengths to tell me how to do it in vinegar or lemon juice in a bowl under a running tap and why it is so important. I counter their arguments with the National Health Service website (NHS, 2017) which explains why it is potentially dangerous whilst at the same time meeting them part way to say that my mum would rinse the inside of a whole chicken. We have reached a compromise: they can wash the chicken and hold onto their belief that it is the right thing to do so long as they do not write about it in an examination paper and, of course, use copious quantities of antibacterial spray at the end of the lesson!

Where does this education lead to? People talk a lot about the importance of cooking as a life skill, but I think this undervalues what we do. Learning about food in school introduces children to the great range of careers in the food industry; if they live in a rural setting, then they would know about farming; if they live in the midlands or the north of England, they may know people who work for Allied Bakeries or Fox's Biscuits and will know about factory jobs. I teach in London where students know about catering but are not familiar with higher-level jobs for which you need a degree. The new GCSE gives a great introduction to all aspects of the food industry, and progression is clear through vocational courses into catering from Post 16. It is a shame that students' access to food-related degrees in higher education in England is only through science A Levels because of the deletion of A Level in food technology (DfE, 2015), and so we need to work together with science and career departments in schools as well as parents to acknowledge the importance of food-related careers.

There are several pressures on teachers, and I think that for a food teacher, there are some subject-specific pressures which I like to challenge. The views of other staff and parents are not always complimentary with them directing students to choose English baccalaureate (EBacc) subjects, believing that a GCSE in food is about making and for lower-ability students and for those who want to enter the catering profession. They are often disdainful when asked to taste students' food, they make comments about how those with behaviour issues would be good at it, or that it would be good for them. I am re-energised by the new GCSE and confident that the subject can hold its head up higher.

And Finally

Society changed over my lifetime, but food education stands the test of time and the buffeting of these changes. To teach children how food is grown and how it is processed and cooked and the nutritional aspects of how it affects our bodies is a key element in a good education system. Why do we need to learn this information? Because it's about understanding concepts that are integral to our well-being, because we need to promote healthy lifestyles in childhood so that the future adult population is less prone to disease and illness, because the world's population is increasing and we need to provide for that with healthy and readily available food which is produced efficiently but showing good welfare for all involved and because we need to be safe when preparing food for ourselves. We need to allow for evolution in our world and draw on our basic knowledge as well as our creativity to use new resources sustainably. Influences are all around us and the modern-day teacher is one tiny aspect that children will take notice of. According to

PricewaterhouseCoopers (2016), the so-called millennials are changing their eating habits because they are influenced by social media: bloggers and apps. We cannot leave this education to celebrity chefs and the media—they enhance the basic school curriculum, not replace it.

A good education in food should be high profile and valued for its contribution to a healthy society and to a well-educated workforce; it should hold its head high in the school league tables with students of all abilities being proud that they take our exams, and as teachers we should be proud of the contribution we make with a subject that is fun to teach. I wonder if we have achieved this ideal?

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Chapter 7
Food and Nutrition Education in Malta: A Journey Across Time and Subject Boundaries

Suzanne Piscopo

Abstract This chapter opens with a historical overview of how food and nutrition education evolved in Malta, looking at its original goals of life skills, health improvement and potential employment and the eventual diversification in focus and target learners in tandem with emerging needs and policies. It then offers a detailed description of the current provision of food and nutrition education in secondary schools, highlighting the prominent role of home economics and the contribution of other subjects such as biology; physical education; personal, social and career development; core science; and, more recently, the VET subjects hospitality, health and social care and agribusiness.

The approach and coverage of food and nutrition education in early childhood education and primary school syllabi is also described, referring to the multicomponent *Fonzu l-Fenek* initiative. Next, the unique function of the state-run Home Economics Seminar Centre is outlined, looking at its various food and nutrition education programmes catering for different age groups and its provision of consultancy services to schools. A summary of the food and nutrition component of home economics national examinations and teacher training for food and nutrition education is also presented.

This chapter concludes with a proposal to adopt the Mediterranean diet as a unifying contextual framework for a new, comprehensive vision and curriculum for food and nutrition education across school subjects and levels.

Keywords Food education · Nutrition education · Home economics · Curriculum Examinations · Teacher training · *Fonzu l-Fenek* · Malta

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Introduction

In a document published in 2012, the Malta Superintendence of Public Health stated that its goal was 'to have a society where healthy lifestyles related to diet and physical activity become the norm and where healthy choices are easy and accessible to all, so as to prevent disease and prolong disability free years of life' (Ministry for Health, the Elderly and Community Care, 2012, p. 8). This goal stemmed from a concern about the health status of the Maltese population and the urgency for action to halt the escalating obesity rates. An expanded food and nutrition education strategy was broached as one of the potential strategies to consider.

Yet, using food and nutrition education (FNE) to improve population well-being is not a recent phenomenon in Malta. Indeed, this chapter will present the origins of formal FNE locally and how this provision developed over the years. It will also map out and discuss the current scenario for FNE up till tertiary level, referring to curricula, syllabi, examinations, special institutions and related teacher training. This chapter will close with a proposal for a new vision for FNE in Malta which goes beyond individual well-being.

A Historical Overview

The story of formal FNE in Malta is bound to the discipline of home economics (HE) and can be traced back to the early twentieth century when the subject of domestic education was indicated as a component of the curriculum for girls in elementary school (Portelli, 1996). Food and cookery were topics taught to girls in preparation for family life as wife and mother, for health risk prevention and for engagement as domestic servants with wealthier families or the families of the British military service in Malta. Domestic economy was introduced in the 1923–1924 Elementary School Syllabus for Standards V and VI (early teens) and covered food and function of food (Malta Union of Teachers, 1923). Portelli (1996) describes how in an oral history interview with a pupil of the time, the interviewee explained that her teacher asked the girls 'to bring any item of foodstuff to school… Then we sorted them out according to their nutritive value' (R Chetcuti, personal communication, July 8th, 1994, cited in Portelli, 1996, p. 51). The interplay between science and economy with respect to the applied study of food was evident even back then. Indeed, in the Regulations of the Government Girls' Secondary School of 1924, domestic science was listed among the subjects to be taught (Malta Government Gazette, 1924).

Attention to FNE was strengthened through the practical schools which were set up in the 1930s to teach academic subjects till age 12 and an applied variation of these subjects after that (Portelli, 1996). Teachers were expected, for example, to teach girls arithmetic related to purchasing of food, measures, simple proportion, household budget management, marketing and profit and loss perhaps (unintentionally) also instilling an entrepreneurial spirit. The 1934–1935 syllabus for the teenage girls was highly practical in orientation when it came to food, as can be seen in Table 7.1.

In 1930 a cluster of domestic subjects was taught at the newly established Central Housecraft School and, soon after, in two more schools (Portelli, 1996). Females coming from elementary schools all over the island attended weekly and later on fortnightly sessions. The subjects taught included childcare, cooking and table manners. In 1936–1937, a housecraft school offering cookery was also opened in the sister island of Gozo. Interestingly, given its growing positive reputation and impact on societal standard of living, the Central Housecraft School in Malta also started running evening classes towards the end of the 1930s, and many students found employment in the domestic service sector once they completed their studies. In the immediate post-war era (1949 onwards), the housecraft schools had a strong vocational orientation aiming to help senior primary school females and children from orphanages train to not only run their home but find employment in domestic service (Portelli, 1996) (Fig. 7.1). Later, in 1958, another course was introduced to train girls in housecraft, catering and cooking which included practical training in

Table 7.1 Elementary school syllabus 1934–1935: housecraft—food component

Standard V	Standard VI
Hygiene The evils of excess in food and drink (sweets, etc.)	*Food and its work* Elementary lessons on structure and requirements of body. The need for food Classification of foodstuffs and the work of each on the body. Proteins, carbohydrates, minerals and vitamins The chief sources of foods. Vegetable, animal, minerals Kinds of foods needed for infants and young children
Care of infants and young children How to… feed … a child over a year old	*Care of infants and young children* How to… feed … them
Cooking Simple home cooking. How to make a broth and vegetable soup. How to cook macaroni and to make tomato sauce Frying—eggs, fish, meat Boiling—milk, eggs, vegetables, fish. How to make tea, coffee, cocoa Roasting—meat, fish. How to toast bread. (N.B. This can be illustrated by preparing simple dishes, which can be utilised by letting children have a meal at school, thus getting practical lessons on table manners, etc.)	*Cooking* Simple home cooking—including cost, cleansing and care of utensils in ordinary use The reason for cooking food The different methods of cooking, e.g. roasting, boiling, baking, stewing, frying, illustrated by preparing simple dishes. How to make plain soups, a milk pudding, custard, a plain cake How to prepare and cook eggs, fish and meat. All cooking can be utilised as in Standard V

Note: Adapted from Department of Education File no. 452/34 Elementary Schools' Syllabus, pp. 17–23, cited in Portelli (1996, pp. 120–123)

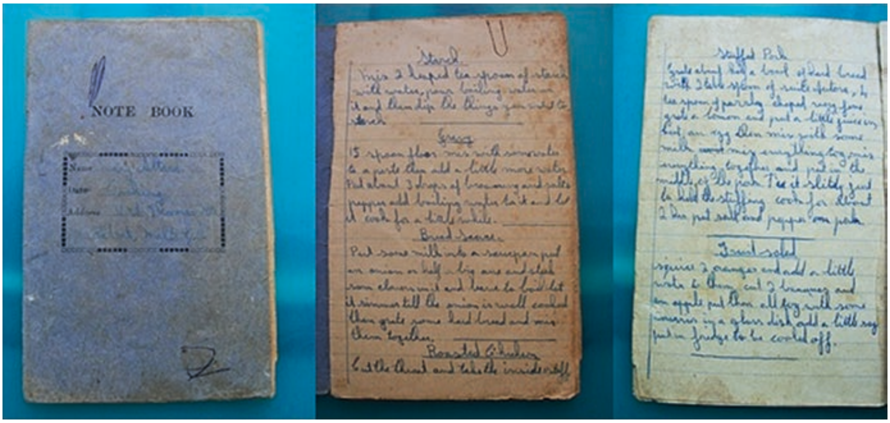

Fig. 7.1 Cover and pages from the notebook of Maria Attard, a young female student attending the housecraft school (circa 1956). Copyright [2019] by Suzanne Piscopo

hotels (Malta Government Gazette, 1958). This was one of the earliest provisions of training for females to working in the hospitality industry.

The housecraft schools took on an even greater significance in the emigration boom of the 1950s when their courses were seen as crucial for offering survival skills required for the long sea voyages of emigrants and their eventual settlement overseas (Portelli, 1996). However, in 1965, the Inspectress for housecraft wanted to change the orientation of what was taught there: 'The new approach was to educate girls and not to turn them into cooks etc.' (Interview with Ms. Rita Chetcuti on 8th July, 1994—cited in Portelli, 1996, p. 79). Subsequently, in 1964, the HE syllabus was framed within a unit approach, one of these units being food and nutrition. Since then, one can say that FNE has always been synonymous with HE. This legacy is even evident today in casual discourse and in the emphasis of food and nutrition as a primary component of any HE course.

The provision of facilities to teach cookery and food hygiene (amongst others) was augmented when in the late 1950s a secondary technical school for girls was established which offered domestic science. The emphasis on domestic science, including food science, may have been linked to a perceived need to boost the image of domestic subjects and their standing in the curriculum, as well as to assist in securing funding for expansion. Eventually, in the 1970s when secondary schooling became compulsory for all, domestic scientific laboratories were set up in all-girls secondary schools (Piscopo, 2006a). These laboratories were equipped to be able to teach the various components of the subject including cooking. They typically had a number of well-serviced kitchenettes where groups of four students cooked together in each one.

As has been seen, the name of the subjects wherein food, nutrition and cookery were incorporated has changed over the years. However, one thing has remained constant: for most of the twentieth century, some form of FNE was offered only to girls in both state and non-state schools. For example, in the early 1960s, girls who were of school-leaving age were given talks by health education officers on various topics including nutrition and food hygiene (Portelli, 1996). Additionally, nutrition was also a component of the courses taught in the post-secondary hairdressing and beauty therapy school established in the 1980s which was predominantly attended by females. It was only in 1992 that HE as a school subject was first offered to boys in state secondary schools. Initially it was marketed to them as providing a foundation for further studies in the hospitality arena, particularly from the food production perspective; and in fact the uptake was high (Zahra, 1996; Casha, 2000). Gradually, non-state boys schools also started offering the subject. Over the years, the female gender association of HE has become some what less pronounced, as HE came to be perceived by the general public as a subject useful to nurture healthier eating choices and cookery skills, important for both sons and daughters (Gerada, 2009).

National Policies Promoting Food and Nutrition Education

In terms of the Education Act, Chapter 327 of the Laws of Malta, the responsibility to promote the health of students based on appropriate health information and promotion and healthy lifestyle programmes falls within the remit of the Ministry for Education and Employment, particularly the Directorate for Educational Services. This legal provision is in line with the WHO's (2019) recent statement as an outcome of the Second International Conference on Nutrition which expressed that:

> Schools are excellent environments in which to address the double burden of malnutrition and install good dietary habits, and to reach the growing market of young people with increasing economic power and influence them to avoid the consumption of foods and beverages high in sugars, fats and salt. Countries should consider increased investment in school health and nutrition programmes. (WHO, 2019, p. 8)

In 1990, the Department of Health introduced the first Malta Food and Nutrition Policy. This was the first national document to directly underscore the value and need for school-based FNE, teacher training in nutrition, and programmes on the subject in the mass media. Since then, a number of national documents have also incorporated FNE into their recommendations as can be seen in Table 7.2. The emphasis was always on increasing knowledge about healthy food and encouraging healthier eating habits and lifestyles, as well as on compatibility between formal instruction and messages derived from the school environment. Reference to practical instruction is also made in some of the policies. Notably, the Healthy Eating Lifestyle Plan (HELP), issued as a guidance document for schools in 2007 by the Ministry of Education, Youth and Employment Education Division, was only recently strengthened as a tool for ensuring healthier school nutrition environments through the Healthy Lifestyle Promotion and Care of Non-communicable Diseases Act (Chapter 550) (Laws of Malta, 2016) which requires schools to promote healthier eating and which led to stricter regulations on what is permissible and not permissible with respect to food

Table 7.2 National policies and strategies which have made reference to food and nutrition education

Entity (year)	Document	Reference to food, nutrition and/or diet
Department of Health (1990)	Malta Food and Nutrition Policy	'Areas that deal with awareness and knowledge – Source book on nutrition – Emphasis on nutrition education in schools – Teacher training in nutrition – Nutrition programmes on TV/radio – Training primary healthcare workers' (p. 13)
Ministry of Education, Youth and Employment (2007)	Healthy Eating Lifestyle Plan	'To make provision for a flexible curriculum which highlights health, diet, nutrition, food, safety and hygiene, food preparation and cooking and which promotes physical exercise as part of a healthy lifestyle' (p. 10)
Ministry for Health, the Elderly and Community Care (2012)	A Healthy Weight for Life: A National Strategy for Malta 2012–2020	'Support schools to implement all the recommendations of the Healthy Eating Lifestyle Plan document [HELP] and to strengthen the personal and social development [PSD] and home economics curricula as related to nutrition and healthy choices' (p. 7) 'Include more emphasis on the food chain in the PSD, physical education and home economics curriculum with particular attention to the importance of a healthy balanced diet as opposed to the consumption of energy-dense foods' (p. 38) 'To increase the inclusion of knowledge on healthy choices and behaviour change strategies in the initial training and continuing education for all health professionals' (p. 52) 'To set up cookery clubs at community level in schools or local councils, workplaces, mother and baby clubs, day care centres, etc. To set up after-school cookery clubs for adolescent children in order to provide practical education on nutrition and healthy eating' (p. 53)
Parliamentary Secretariat for Health (2014)	Food and Nutrition Policy and Action Plan (2014–2020)	'To further consolidate current school initiatives intended to promote and protect healthy diets, drinking of plain safe water and physical activity…' (p. 52)
Ministry for Education and Employment (2015)	A Whole School Approach to a Healthy Lifestyle: Healthy Eating and Physical Activity Policy	'Make provision for a flexible curriculum which highlights health, nutrition, food safety and hygiene and food preparation, which promotes physical activity Ensure that clear and consistent messages about food, drink and physical activity are delivered across the school day as to reinforce the health messages consistent with those promoted by the health authorities' (p. 8)

provision and availability in schools (Subsidiary Legal Notice 550.01) (Laws of Malta, 2018). Since 2007, the HELP document has been at the forefront in putting FNE on the agenda of school development plans.

Food and Nutrition in the Formal Curriculum

In 2012, Malta adopted a new national curriculum based on a Learning Outcomes Framework (LOF) (Ministry of Education, Employment and the Family [MEEF], 2012). This brought about a revision in the syllabi of many subjects with the focus turning to the learners, their entitlement and their achievement path. The national curriculum document states that by the end of compulsory schooling, all students should 'understand the importance of nutrition and eating in a healthy way' (p. 55) and schools should facilitate learning that 'strives towards a world in which all humans have access to sufficient food and water, a healthy and productive life…' (p. 38). This is now happening through various routes.

The historical overview presented earlier outlined the development of FNE in Malta, primarily through its incorporation in the HE discipline or other more vocationally oriented subjects. This association is not unique to Malta and has been experienced in several regions of the world (Piscopo, 2019; Smelkova, 2015). For example, Japan's obligatory food education called 'Shokuiku' is often covered via HE lessons (Suzuki, 2014), whereas in Canada, 'Home Economics Foods and Nutrition courses provide the only opportunity for students to learn about nutrition and healthy eating through the "hands-on" food preparation that is recognized as more effective in changing behaviour than knowledge transmission' (Smith & Zwart, 2010, p. 17). In Ireland, HE has been presented as key to effective whole school programmes and interventions around food and health education (McCloat & Caraher, 2016), and Australian researchers have shown that HE education results in long-term changes in food knowledge (Worsley et al., 2015). Finally, in many African countries, elements of FNE are incorporated in HE or agricultural training in academic institutions (McNulty, 2013).

Fast forward to 2019, one can say that although HE is still a key provider of FNE in Malta, related topics have also been integrated in other school subjects at secondary level and have also filtered their way into the primary level, perhaps even more strongly in early childhood education.

The Contribution of Home Economics at the Secondary Level

In the 2012 national curriculum, HE was listed as a core entitlement subject within the learning area 'Health and physical education' (MEEF, 2012). As a result, all students become entitled to some HE education during their secondary years of schooling. In state schools, this has translated into all Form 1 and Form 2 students having HE lessons for half the scholastic year. In the non-state sector, each school has its own delivery schedule and format.

'Food, nutrition and health' is one of the three main strands within the current Form 1 and Form 2 state school syllabus (see Tables 7.3 and 7.4). The topics included are typical of what has been covered in HE for decades, ranging from the nutrients and balanced diets to food safety, meal planning and food production. There is also a strong practical component where students have to cook a variety of healthy snacks and dishes. The topics are anchored in current lifestyles, such as through addressing the use of takeaway foods or comparing food labels with the latest dietary guidelines. At the same time, there are many opportunities to develop some basic culinary skills, aligning with food production suited to this age group as well as some fundamental cooking processes. There is also emphasis on using the practical session for training in transferable skills, such as planning, organisation, critical thinking, evaluation, time management and teamwork. Casual conversations with HE teachers have revealed that whilst some hailed this compulsory entitlement a step forward in exposing students to food and nutrition knowledge and skills which could help them in choosing and adopting a healthier lifestyle and thus also reduce the risk for a variety of health problems, others felt that the time was very restricted and the depth and scope of FNE somewhat limited. Possibly, with the latter in mind, and given the life skills orientation of HE, a constructivist approach is

Table 7.3 Home economics secondary syllabus Years 7 and 8: food, nutrition and health.

Form 1	Form 2
I can identify the five nutrients and outline their role in the diet I can explain what makes a balanced diet and identify ways how to adopt it I can identify the current dietary guidelines and explain their role I can interpret the local food guide I can distinguish between healthy and less healthy snacks, particularly for adolescents I can justify the importance of breakfast I can plan various healthy breakfast options with reference to different cultures I can justify the health benefits of milk and fruit I can describe how food should be handled, cooked and stored safely to prevent the development of microorganisms I can outline the skills needed for the rubbing-in method of cake-making	I can explore carbohydrates and fats and explain their link to health I can identify factors affecting food choice I can list the current dietary guidelines and explain their role I can adapt and modify basic methods of food preparation according to the dietary guidelines I can locate information found on food labels and link to dietary guidelines I can describe the advantages and disadvantages of consuming takeaway food I can outline the skills needed for the making of short-crust pastry
I can give examples how to apply the dietary guidelines I can adapt and modify basic methods of food preparation according to the dietary guidelines I can work on a given task individually and in collaboration I can research, collate and present data collected as part of a given task I can create and evaluate according to a set of criteria	

Note: Adapted from Home Economics Syllabus Year 7 and Year 8, Department for Curriculum, Lifelong Learning and Employability, 2018, pp. 9–12

Table 7.4 Home economics secondary syllabus Years 7 and 8: practical interventions

Form 1	Form 2
I can plan, prepare, serve and evaluate suitable, healthy snacks and packed lunches for adolescents I can demonstrate different types of skills, such as peeling, grating, slicing, dicing and chopping in food preparation I can plan, prepare, serve and evaluate a healthy dessert which includes milk and fresh fruit I can use the rubbing-in method of cake-making to prepare simple dishes	I can plan, prepare, serve and evaluate simple dishes to minimize food waste and safely make use of left overs I can plan, prepare, serve and evaluate simple rice and pasta dishes to illustrate the role of some nutrients in the diet I can make short crust pastry I can demonstrate different types of cooking skills, such as sauce-making, boiling and baking
I can follow instructions when working on different tasks I can read and follow a recipe I can fill in a preparation sheet for a given practical assignment I can work within a time frame I can demonstrate safe and hygienic practices during preparation, cooking and storage of food I can accurately interpret and use standard forms of measurement in recipes I can do the washing up in an environmentally friendly way I can demonstrate the proper use and care of work surfaces and utensils in the food lab I can prepare and serve a dish attractively on a correctly laid table I can talk about, review and make improvements to work, reflecting on the process and outcome	

Note: Adapted from Home Economics Syllabus Year 7 & Year 8, Department for Curriculum, Lifelong Learning and Employability, 2018, pp. 9–12

encouraged for the lessons so that content is presented in a manner to make it more integrated and meaningful. The syllabus is in fact prefaced by the statement that:

> This may require the integration of theory and practical lessons to achieve the learning outcomes. All activities need to be highly contextualised so that the learners see relevance and are engaged in the process. Learning needs to be authentic so that the transfer of learning occurs, and learners can identify it in realistic situations. (Department for Curriculum, Lifelong Learning and Employability [DCLLE], 2018, p. 4)

As students' progress through secondary schooling, they can eventually choose to specialise in HE in Forms 3–5 where they benefit from additional weekly lessons and are thus able to gain more depth of knowledge and a broader range of skills. At this level, topics covered include: the scientific aspect of food and nutrition; the relationship between disease and lifestyle; topical issues such as food additives, allergies, eating disorders; the variety of food commodities and their smart, efficient choice and preparation; and trends in food production and consumption, such as organic farming and use of convenience foods (Directorate for Learning and Assessment Programmes [DLAP], 2013a, 2013b) (see Table 7.5).

The various HE syllabi, from Form 1 to Form 5, place a strong emphasis on sustainability, so that food traditions, food justice, food waste and environment-friendly food production methods are discussed and incorporated where feasible. Attention is also given to the social aspect of conviviality and presenting and sharing of meals in a pleasant environment. Learning outcomes such as 'I am able to address topical

Table 7.5 Home economics secondary syllabus Years 9–11: food, nutrition and health

Form 3	Form 4	Form 5
Functions of food, the food groups and the dietary guidelines The food guide pyramid[a] Introduction to the nutrients: proteins, carbohydrates, non-starch polysaccharides, fats and oils, vitamins, minerals, water Food commodities: milk and dairy products, eggs Recipe engineering Safety and hygiene in the food lab/kitchen	Factors affecting food choice The process of digestion Food commodities: meat and meat products, fish, fruit and vegetables Organic farming and genetically modified foods Meal planning for the different dietary requirements Methods of cooking	Food spoilage, contamination and poisoning The use of convenience food Preservation of food Freezing Food packaging Food labelling Food additives Food commodities and cooking methods Hygienic practices in the handling and preparation of food

Note: Adapted from Home Economics Syllabi Years 9–11, Directorate for Learning and Assessment Programmes (2013a, 2013b)
Practical component: Preparation of meals with emphasis on the basic skills, the nutrients, meal planning, food commodities and cooking methods: Shortcrust Pastry, Cake making; Yeast as a Raising Agent; various meals to suit different dietary needs
[a]Now revised to refer to the Maltese Healthy Plate

issues such as food miles, carbon footprint and food waste', 'I can explain differences between organic and non-organic foods and GM crops', 'I appreciate the value of eating together with family and friends', 'I know how to minimise food waste and safely make use of leftovers' and 'I can plan, prepare, serve and evaluate healthier versions of traditional Maltese recipes after having modified them' are testament to this (Ministry for Education and Employment [MEE], 2019d).

The Contribution of Other Subjects at Secondary Level

Over the years, a number of other subjects have been providing FNE, to different degrees, to all or a restricted group of secondary school students. The nutrients and the digestive system have always been standard components of the local secondary-level biology syllabus, and a small section on nutrition and healthier lifestyles was included in the recent physical education specialisation syllabus leading to the SEC ordinary-level exam. But these are typically optional subjects (in both state and non-state schools), which means that only students who choose them will be exposed to the food and nutrition components. In fact, for many years, only students who chose HE or biology had this educational provision. As a result, in the early 2000s, aspects of diet and healthy eating were incorporated in personal, social and career development (PSCD; back then called personal and social education [PSE]), which is a subject that all students had, and still have, in state schools and the majority of non-state schools. Similarly, more recently, food and nutrition topics were included in core science which is also taken by all students at secondary level. For some years, FNE was also provided through the subject food technology, where food was the working material in a design and make approach. This subject has now been phased out, very likely due to curricular developments linked to the introduction of other food-related subjects such as hospitality and possibly due to anecdotal evidence from students and teachers which seemed to indicate that there was quite an overlap with HE in what was taught, despite the intended difference in orientations (family well-being and resource management vs. mass production).

Tables 7.6 and 7.7 show how food and nutrition topics are currently addressed across the two subjects of biology and physical education. Some commonalities are the nutrients, balanced diet and link with health maintenance and health problems.

Table 7.6 Food and nutrition objectives and tasks in the Form 4 biology syllabus for state schools

Topics	Practicals
To list the constituents and know the functions of each in a balanced diet To understand the function of each of the components of a balanced diet To explore the deficiency diseases related to a general lack of one or more basic food component To understand the structure and function of enzymes To describe how the process of respiration releases energy from food To understand the role of digestive enzymes To list examples of enzymes involved in the digestion of carbohydrates, proteins and fats To understand the fate of assimilated food and undigested matter	Food tests (a) Chemical tests for reducing sugars, starch, lipid and protein (b) Identifying substances that make up a selection of common foods (c) Investigating the vitamin C content in different foods (d) Investigating the effect of cooking on vitamin C content (e) Investigating the energy content in different foods Enzymes (a) Investigating the action of enzymes in relation to digestion. Use of different enzymes on different substrates (e.g. protein, starch) and under different conditions (e.g. pH and temperature) (b) Investigating the economic importance of enzymes as demonstrated by the production of cheeselets and yoghurt

Note: Adapted from: Department of Curriculum and Management, Education Division—Biology Form IV Syllabus for State Secondary Schools, 2007

Table 7.7 Food and nutrition topics in the physical education SEC syllabus: health-related fitness section

• A balanced diet: carbohydrates, fats, proteins, vitamins (A, C and D), minerals (calcium, iodine, iron), water, fibre
• Beneficial effects of these substances in the body and foods rich in these substances
• Definition of basal metabolic rate (BMR)
• Caloric intake, caloric expenditure
• Diet related to physical activity performed
• Diet before, during and after physical activity
• Dietary problems: obesity, anorexia

Note: Adapted from: University of Malta – MATSEC Examinations Board, 2019a, Physical Education 2019 SEC Syllabus

In the PE syllabus, the interest in energy (calorific value) and performance is evident, whereas in the biology syllabus there is emphasis on composition of foods and influencing factors and also various practical investigations related to these. The biology syllabus also introduces the role of food science in food product development, perhaps spurring an interest in a career in such area among students. Of note is that HE teachers have revealed (personal communication through Home Economists in Action professional association) that in some schools HE, PE, biology and other teachers collaborate to ensure that messages taught are complementary, whereas in other schools, students doing HE will sometimes express confusion saying that *they learnt it differently* in another subject (e.g. HE typically refers to five nutrients; biology sometimes refers to six nutrients by including water.)

Tables 7.8 and 7.9 show the food and nutrition-related learning outcomes for PSCD and core science, both of which are taught to state school students. In PSCD, learners are encouraged to reflect on their food choices and behaviours with respect to personal and community well-being. They compare different options and also consider influences on choices and the various impacts of choices. In core science, the active learning, problem-based inquiry approach stands out and is in keeping with the vision of the subject 'bringing together knowledge from different areas to show the coherence of science and the need to use concepts from different sciences to understand natural phenomena and to solve everyday problems' (MEEF, 2011, p. 12). Indeed, food and health are tackled holistically, addressing the underlying scientific principles whilst engaging the students through exploration and discussion and allowing them to better understand the function of food at the micro and macro levels. Food is investigated and presented by the students themselves in relation to various problems and settings to enable them 'to make informed decisions as they strive to improve their quality of life and to understand the changing contexts' (MEEF, 2011, p. 10).

Table 7.8 Food and nutrition learning outcomes within personal, social and career development

LOF level 7 I can explain the value of choosing beverages that help me to be well and stay well I can explain the similarities and differences between an energy drink and a sports drink I can assess and explain the impact of energy drinks on my own and other people's physical and mental well-being
LOF level 8 I can explain what is meant by healthy lifestyle, e.g. what sort of foods can help me be well physically and mentally, etc. I am able to assess my own lifestyle and my contribution to sustainability
LOF level 9 I can describe the commonalities and differences between healthy and unhealthy lifestyles, e.g. awareness of the influence of media on health-related issues, eating disorders I know the links between eating disorders, unhealthy eating and low self-image I can explain the concept of 'fair trade' I know ways in which individuals and organisations can contribute to sustainable development locally and globally and I know about Agenda 21

Note: Adapted from: Ministry for Education and Employment (2019e). Learning Outcomes Framework: Personal, Social and Career Development

Table 7.9 Food and nutrition learning outcomes within core science

LOF level 7
I can differentiate between microbes which are harmful and others which are useful to the human body
I can develop food plans for people with different dietary needs
I can investigate how the energy value of different foods is measured
I am able to compare the energy values of different foods from labels and relate this to body needs, depending on activity and lifestyle
LOF level 8
I can describe the human digestive system
I can name some common allergens and describe their effects on the human body
I can explain what is meant by genetic engineering and explain how genetically modified foods can be engineered for our benefit
I can explain how healthy eating is beneficial
I can develop a presentation to convince my peers that eating healthily has a positive effect on our bodies including our circulatory system
I can use a chemical test to investigate and identify food groups
I can carry out experiments to compare the energy content of some foods
LOF level 9
I can discuss the benefits of eating local produce and organic food
LOF level 10
I can research the carbon and nitrogen cycles and explain their importance to the environment and to food production
I am able to discuss and evaluate measures being taken to mitigate the effects of climate change on crops and our environment
I can discuss the arguments for and against the use of genetic engineering, acknowledging the empirical evidence, data and beliefs that make this debate so challenging
I can discuss sustainable agribusiness practice in Malta and how innovation in agribusiness is based on scientific understanding

Note: Adapted from: Ministry for Education and Employment (2019b). Learning Outcomes Framework: Core Science

The Contribution of Vocational Education and Training (VET) Subjects at Secondary Level

A curricular development in recent years which has brought a shift in the presentation of FNE to secondary-level students was the introduction of vocational education and training (VET) subjects (MEEF, 2012). Three VET subjects in particular have strong to somewhat strong FNE-related components. These are hospitality, health and social care and agribusiness. The subjects hairdressing and beauty and retail also incorporate elements of food, but in a much more limited manner (MEE, 2019a).

The depth, extent and orientation of the food and nutrition knowledge and skills provision in the VET subjects differ according to where and how it will be used in potential employment contexts. The intent is for the students to experience the applied nature of food and nutrition in relation to their potential place of work. So much so, the 2019 policy document for the VET Secondary Education Certificate

(SEC) states that 'Applied vocational subjects are directly related to the work place. Students will be assessed on the theory and practical skills indicated in the respective subject syllabi' (University of Malta, 2019b, p. 4). For example, as can be seen in Table 7.10, in hospitality, the focus is strongly on nutritionally appropriate, aesthetically pleasing and safe food preparation and presentation. In health and social care, there is a similar emphasis on the value of a balanced diet, with additional attention to the association between food and different body systems in order to

Table 7.10 Select learning outcomes from the syllabi of the SEC VET hospitality, health and social care and agribusiness

Hospitality
Learners should
Identify the Maltese dietary guidelines, the nutrients, their function and sources
Explain different diets relating to different lifestyles and conditions including food restrictions and their replacement
Describe the various styles of different cuisines
Outline the different cooking methods
Identify equipment and their uses in food preparation and serving
List meals using fish as a main ingredient in local and current cuisines and the features to look for when buying and storing fish
Outline the main cuts of meat and poultry and their cooking variations
Describe what to look for when buying and storing eggs and dairy products including their use in food preparation
List a variety of products made from different cereals and dishes containing these products
Explain the different cutting techniques and the importance of correct cooking of fruits and vegetables
Describe ways of preventing food poisoning
Describe the different types of pastries
Explain the properties and uses of the whisking and rubbing—in methods
Demonstrate dishes using pastry techniques to produce sweets in a safe and hygienic way
Discuss the quality checks to follow when cooking and serving dishes by suggesting ways to improve the sensory features in a meal
Demonstrate appropriate preparation, cooking and plating skills of a two-course meal
Health and social care
Learners should
Identify the physical needs throughout the life stages: e.g. balanced diet, etc.
Outline the different lifestyle factors which influence the health and well-being of individuals: e.g. diet, exercise, etc.
Outline the main systems in the human body with their main function: e.g. digestive system, ingestion, digestion, absorption and elimination of food; cardiovascular system, transport of nutrients, waste products, etc.
Agribusiness
Learners should
Outline fruits' and vegetables' nutritional features
Outline the production of the most commonly grown vegetables in the Maltese islands
Undertake a season's growth of different groups of vegetables
Predict possible future trends in the local consumption of fruits and vegetables

Note: Adapted form University of Malta, MATSEC Examinations Board SEC VET 2019 Syllabi for Hospitality, Health and Social Care and Agribusiness facilitate feeding, to render the food consumed more beneficial to the individual, or to manage or prevent diet-related problems. In agribusiness, there is a focus on production, nutritional value and consumption of vegetables and fruit.

Food and Nutrition at Primary Level

In 2006, Piscopo presented a paper at an international conference and, subsequently, to the local education authorities on the need for developing a national strategy for nutrition education in Maltese primary schools (Piscopo, 2006b). To make her case, Piscopo laid out various arguments, ranging from the worrisome health status of children to children's nutritionally inappropriate dietary patterns and to the various lacunae in children's food and nutrition knowledge, attitudes and perceptions. Piscopo concluded that there was an urgent need for a formal curriculum based on a sequential framework of food and nutrition learning outcomes starting from the early years right through primary schooling. This would need to be accompanied by guidance for teachers on the transversal integration of food and nutrition topics within different subjects using a skills-based approach, ideas for family and community involvement, identification and production of age and culturally appropriate learning resources, and identification of food and nutrition competencies to be reached by teachers via pre-service or in-service training.

Since then, a lot has been achieved with respect to FNE for the younger learners. In the early years setting, food is often used as a resource around which to build different knowledge and skills. Some of the learning outcomes at this level include the following: 'I can manage my physical wellbeing and demonstrate self-care skills in the school setting e.g. eat my lunch, washing my hands', 'I actively participate in activities that require me to take an initiative e.g. cooking' and 'I participate in celebrations of customs from different culture traditions e.g. Christmas, Ramadan, Hanukkah etc.' (MEE, 2019c). The recommended emergent curriculum offers fertile grounds for FNE to arouse curiosity and facilitate discovery among the younger students.

Food sources, characteristics, composition and production, as well as healthy eating choices, food preparation and food safety, together with food traditions and culture and the role of food in sustainability issues now also feature in the different syllabi across the years in primary schooling. Table 7.11 outlines learning outcomes for PSCD and science which target senior primary school students and are directly or indirectly linked to food, nutrition and holistic health. A number of outcomes are common to both the subjects, particularly those related to making healthy dietary choices and practising good food hygiene. However, the PSCD outcomes also target issues around the right to food and food in relation to sustainable development, whereas science outcomes also look at food supply, food and the senses and the different nutrients and nutritional value of food. The science syllabi of Year 3, Year 4 and Year 6 (7–8, 8–9 and 10–11 year olds, respectively) encourage teachers to create a variety of learning activities on various topics as can be seen in Table 7.12, where learners are guided to construct their own learning through different learning opportunities.

Table 7.11 Select learning outcomes for personal, social and career development and core science in the senior primary years

	LOF level 5	LOF level 6
Personal, social and career development	I can make simple choices which affect my health and well-being, e.g. between food, activities, free time I know what is meant by a healthy diet I can describe the types of food that make up a healthy meal I know the food preferences and diets of children in different cultures/countries I know and can describe the choices open to me and I can talk about some basic skill of appropriate decision-making, e.g. in food I can talk about what children's rights are and what they can help children do, e.g. the right for protection and care, which includes the basic need for food, etc.	I can choose healthy options in relation to my health, e.g. food, drinks, etc. I can manage hygiene procedures, e.g. food safety I can identify and describe the meaning of sustainable development I can identify what actions can be taken at school, at home and in the local community to contribute to sustainable development
Core science	I can identify some characteristics of a living thing: nutrition, etc. I can explain how animals obtain their nutrition by consuming plants or other animals I can describe in simple terms how a plant obtains energy I can draw and label a simple food chain I can identify healthy and unhealthy food I can demonstrate some things I should do to keep myself healthy I can construct a food plate using pictures of common foodstuffs I can design my own food plate made up of a balance of different food types, namely, bread and cereals, fruit and vegetables, meat and beans, eggs and cheese, oils and nuts I can demonstrate basic proper hygiene whilst cooking and keeping food safe I can give examples of how we use our five senses to gather information about the world around us I can identify parts of the body that are directly and indirectly involved in tasting I can identify familiar substances by way of smell	I can understand that plants are important to human beings for various purposes (e.g. edible plants) I can describe which plants are important for food and find out where they come from I can identify which plants are grown in Malta for food and when is the best time to grow them I can list the five main nutrients the human body needs and explain their role and the importance of fibre in a healthy diet I can apply my understanding of a balanced diet to suggest improvements to what I eat (e.g. keeping a food diary) I can interpret food labels and relate to identifying foods that should not be consumed in excess (e.g. amount of sugar, saturated fats, salt, additives, etc.)

Note: Adapted from the Ministry for Education and Employment (2019b, 2019e). Learning Outcomes Framework: Core Science and Personal, Social and Career Development

Table 7.12 Select learning opportunities for core science in primary Years 3, 4 and 6

Year	Learning opportunities
3	Use a journal to follow their eating habits Build up class chart showing good eating habits Use a journal and follow their daily practices regarding these three activities: exercise, personal hygiene and diet Give practical examples of things they should do to keep their body fit and healthy Sort food items according to their taste Sort items according to their scent Understand the importance of smell for our safety in everyday life
4	Design and make a food plate, e.g. for a school snack, for a children's party, etc. Practise proper hygiene when handling food, namely, washing hands well before handling food; washing fruits and vegetables thoroughly; using different utensils for different food types, e.g. raw meat and vegetables; refrigerating certain food to keep fresh
6	Classify food into basic categories such as meat, eggs and cheese, fruit and vegetables, bread and cereals Use the above classifications to build a healthy diet

Adapted from the Ministry for Education and Employment (2019b). Learning Outcomes Framework: Core Science

The Fonzu l-Fenek *Mascot*

In 2011, an original cartoon-style mascot was created in order to encourage children to adopt healthy lifestyles, especially healthy, sustainable eating habits (Fig. 7.2). Over the years, *Fonzu l-Fenek* (Fonzu the Rabbit) and subsequently his 'friends' have featured in a variety of teaching and learning resources which were developed targeting younger primary school children (Times of Malta, 2013; Television Malta, 2016). Resource packs incorporating students' workbooks and teachers' handbooks, PowerPoint presentations, recipe books and sheets, picture comics, board games and a number of songs and complementary online resources including song videos, recipe-making videos and photo stories with narration have been made available freely to teachers and early childhood educators through the Ministry of Education or via the website www.fonzulfenek.org. The goal is for early childhood educators and teachers to have culturally sensitive, age-appropriate resources to facilitate adopting a thematic or a cross-curricular approach for incorporating food and nutrition education into their yearly programmes. In-service training courses have also been run for teachers, and *Fonzu l-Fenek* remains a regular guest at special school assemblies and special school events where the messages of healthy and sustainable eating are transmitted using an edutainment format (Foundation for Environmental Education, 2018).

A short-term evaluation of the implementation of the original *Fonzu l-Fenek* resource pack materials using a pre- and post-test questionnaire (pre $n = 331$, post $n = 354$) and class-based or small-group interviews ($n = 13$) with children, a feedback sheet ($n = 18$) and individual or small-group interviews ($n = 8$) with teachers, school management team member interviews ($n = 3$) and phone interviews with

Fig. 7.2 The cartoon mascot *Fonzu l-Fenek*. Copyright [2011] by Michael and Suzanne Piscopo

parents ($n = 5$) revealed that in the short-term, there was an overall increase in knowledge (+2.7% to +25.7%) among Year 2 students (6- to 7 year olds) with respect to different aspects of food and diet (Piscopo, 2012). However, results need to be interpreted with caution due to certain limitations, such as a lack of students' control group, inconsistency in the extent to which teachers used the materials with their students, and variation in the teachers' level of nutrition knowledge. Nonetheless, feedback on the resources' pedagogical value and usefulness for teachers was very positive, and the materials were eventually revised and augmented.

The Home Economics Seminar Centre

In the early 1990s, the Maltese National Minimum Curriculum introduced the subject personal and social education (PSE) at secondary level with the goal of offering a selection of life skills to all secondary school students (Piscopo, 2006a). As a result, in 1992, a special PSE Seminar Centre was established where students from Form 3, 4 and 5 (13–15 year olds) of both state and non-state schools could attend half-day seminars on different topics. The Form 3 topic was specifically focused on nutrition. It addressed healthy eating choices and actions and included a hands-on component where students made their own buns with different healthy fillings during the mid-morning break.

Over the past 25 years, the Home Economics Seminar Centre (HESC) (as it eventually was renamed) has continued to grow and offers a series of programmes around food and nutrition for school children from kindergarten age to senior secondary level (Directorate for Learning and Assessment Programmes, Home Economics Seminar Centre, 2019) (see Table 7.13). These programmes utilise constructivist pedagogies incorporating a variety of active learning strategies. The Centre also

Table 7.13 Food and nutrition programmes offered by the Home Economics Seminar Centre

Year	Target	Programme name	Focus
Kinder 2	Students	*Ħamsa Illum… Kul Minna Kuljum!* (Five Today, Eat Us Every Day!)	Vegetables and fruit
Year 1	Students	Mind Your Manners	Good table manners
Year 2	Students	Milk Power	Daily consumption of fresh white milk and healthy dairy products
Year 3	Students	A Healthy Breakfast for a Good Start	Healthy and less healthy breakfast foods
Year 3	Parents	*Gawdi Saħħtek u Saħħet Uliedek* (Enjoy Your Health and Your Children's Health)	Establishing good eating habits among children
Year 4	Students	Cool Lunch Boxes	Healthy, balanced and tasty school packed lunches
Year 5	Students	*Duq il-Qawsalla* (Taste the Rainbow)	Daily consumption of different-coloured vegetables and fruit
Form 1	Students	Nutrition Alert	Improving one's lifestyle and healthy eating practices
Form 2	Students	Aliens in Our Food	Food safety and hygiene
Form 2	Students	Smart Snacking	Making healthier choices when preparing and buying snacks
Form 3–5	Students	Nutrition—C.S.I.	Investigating breakfast foods, school tuck shop foods, afternoon snacks and fast food outlets

Note: Sourced from the Directorate for Learning and Assessment Programmes, HESC, 2019

offers a parallel programme for parents of Year 3 children and organises professional development training for teachers on nutrition, food hygiene and FNE pedagogy. The HESC is staffed by HE teachers who develop, pilot, implement and evaluate the programmes, and it is funded primarily by the education authorities. A unique aspect of the Centre's remit is the provision of consultancy and guidance to schools on implementation of the Whole School Approach to a Healthy Lifestyle: Healthy Eating and Physical Activity Policy (Ministry for Education and Employment, 2015). HESC staff assist school management teams, staff and parents in the formulation of school development plans and in ensuring adherence to regulations on school food provision.

Food and Nutrition Component in Home Economics National Examinations

As illustrated earlier, HE has been a main source of FNE in Malta for many decades. Indeed, by the 1960s, Oxford examinations in areas like cookery and HE were offered regularly in Maltese schools (Portelli, 1996). In 1994, a home-grown ordinary-level Secondary Education Certificate (SEC) examination in HE was offered for the first time by the University of Malta. In 1996, the first local advanced-level examination was launched, followed a few years later in 2003, by an intermediate-level examination. Since their inception, all the local examination syllabi, at every level, have had a strong food and nutrition component (Piscopo, 2006b).

The current advanced-level home economics and human ecology (HE&HE) assessment and the SEC HE assessment have a written examination paper dedicated specifically to food, nutrition and health (see Table 7.14). The syllabi for this paper comprise topics related to food commodities, food production, nutrition, applied nutrition and dietary influences, habits and needs. The intermediate-level syllabus has a separate section on food science and nutrition; however, in the examination paper, the topics from this section are integrated with other section topics on consumer issues and concerns and the family in society, showing the interlinkages between knowledge, decisions, actions and contexts.

Another component of the advanced- and ordinary-level HE assessments is the *Coursework*, where students are required to carry out an investigative study which could have a direct or indirect food or diet focus, as well as conduct other practical

Table 7.14 The food-related sections of the HE assessments at different levels

	Ordinary level	Intermediate level	Advanced level
	Food, nutrition and health	Food science and nutrition	Food, nutrition and health
Aims	'To develop the knowledge, understanding, skills and attitudes necessary to meet nutritional recommendations and healthy lifestyles'	'This area deals with factors affecting food choices, the relationship between diet and health, the scientific principles in the production, processing and preservation of foods'	'The study should integrate nutrition and food technology within the historical, social, economic and scientific perspectives and through these develop an understanding of their application to modern society'
Coursework option areas	Food preparation and technology, hospitality services, child development, the elderly	(No coursework)	Food technology, child development, senior members of society, hospitality services, textiles studies
Coursework components	An investigation on one of the option areas (which could be food preparation and technology) Two practical assignments carried out under time-controlled conditions	(No coursework)	An investigation on one of the option areas (which could be food technology) A food study task focusing on one food commodity and comprised of: – a related experiment – a food production task or culinary skill
Written exam	Incorporates questions about the knowledge content and its application	Incorporates questions about the knowledge content and its application	Incorporates questions about the knowledge content and its application

Sourced from University of Malta MATSEC syllabi: http://www.um.edu.mt/matsec/syllabi or food tasks. The advanced level involves a food study task where the emphasis is on scientific experimentation, food innovation and culinary skills. At ordinary level, the practical assignment aims to evaluate application of nutrition knowledge and culinary skills. All coursework is assessed internally with moderation by the examining body.

Casual discussions with HE secondary school teachers and post-secondary lecturers over the years have highlighted how the food and nutrition component and the practical component of HE are two of the major attractions for students. In a recent study by Debono (2019), males studying advanced-level HE&HE indicated a strong preference for topics related to food, health and nutrition. They further suggested that inclusion of other topics such as sports nutrition, fitness and food testing could encourage more males to select the subject due to lifestyle trends and the association with science. The latter may also be a potential catalyst for developing an interest for a career in food science. Currently, students doing advanced-level HE&HE often move on to more advanced food-related courses, such as in the hospitality industry, or in applied food studies at tertiary level if they also have advanced-level biology or chemistry.

Teacher Training in Food and Nutrition

The Central school was a training institution for prospective teachers in the early 1920s and is considered as having had one of the earliest comprehensive domestic economy courses (Portelli, 1996). The teacher training syllabus included sections on food which tackled composition of food, function of food, food preparation, digestion and blood circulation. HE and thus FNE teacher training continued pre- and post-war till eventually, in 1978, the University of Malta launched a Bachelor of Education (B.Ed. Hons) in HE with a strong element of food, nutrition and health education and targeting secondary school teacher trainees. Over the years, the extent and type of content and skills offered in the HE teacher training have changed, although food and nutrition knowledge and pedagogical training have remained synonymous with the subject. Table 7.15 shows the various food-, nutrition-, health- and consumer-related study units offered in the University of Malta HE teacher training degrees from different decades. It is evident that these areas have become more pronounced in recent years. Food production practical skills training was reintroduced, and new aspects, such as sociocultural issues of food, food ethics and sustainable consumption, were also included. The year 2016 saw the launch of the 3-year Bachelor of Science (B.Sc. Hons) in HE as the first step to the phasing out of the B.Ed Hons course faculty-wide. The B.Sc. HE allows for a stronger coverage of food, nutrition and health topics, especially for those students who choose to specialise in this path in their second and third year. As from October 2019, those wishing to train as teachers have started enrolling in a Masters in Teaching and Learning in HE where the focus is on pedagogy and assessment. Similar MTL programmes are being offered to those wishing to train as hospitality and health and social care

Table 7.15 Food and nutrition components of three teacher training degree programmes from the University of Malta

B.Ed. (Hons) in Home Economics and Early and Middle Years (1983)	B.Ed. (Hons) in Nutrition, Family and Consumer Studies (2015)	B.Sc. (Hons) Home Economics (2019) + Masters in Teaching and Learning in Home Economics (2019)	
		B.Sc. (Hons) Home Economics	MTL Home Economics
Fundamental principles of nutrition	Principles of human nutrition (including foundation science)	Principles of human nutrition	Current issues and perspectives in home economics
Applied nutrition I	Applied human nutrition	Applied human nutrition	Pedagogies for specific aspects in home economics
Applied nutrition II	Towards healthier living	Towards healthier living across the lifespan	Practical and demonstration skills and settings in home economics
Food science, technology and microbiology I	Principles and applications of food science and food technology	Nutrition and dietary planning for individual needs	
Food science, technology and microbiology II	Applications of food technology in home economics	Application of nutrition and dietary planning for food and meal development	
Health education through home economics	Nutrition and dietary planning for individual needs	Principles and applications of food science and food technology	
	Health and nutrition education	Sociocultural issues in health and nutrition	
	Practical skills in home economics	Ethics in food and nutrition	
	Advanced practical skills in home economics	Perspectives in health, consumer and sustainability policies and research	
		Principles of health promotion and public health nutrition	
		HE interventions for behaviour change within a lifelong learning perspective	
		Food preparation skills for health and wellness (1)	
		Food preparation skills for health and wellness (2)	

Note: Sourced from University of Malta, Faculty of Education archives and documentation teachers. Their training also has a food and nutrition component, but with a specific orientation in line with the secondary school syllabi described earlier.

As from 2004, HE faculty have led the way in training prospective primary school teachers and early childhood educators in health, food and nutrition education, enhancing their substantive knowledge and skills to be able to incorporate these topics effectively in their learning activities. The training has typically been of a minimum of 14 h duration and has involved lecture type sessions on food and nutrition knowledge and pedagogy, as well as workshops in learning resources evaluation and development, and occasionally hands-on sessions providing practice in organising a cookery session with young children. In the new MTL in early childhood and primary education, food and nutrition pedagogical training is incorporated within a study unit on science education.

A New Vision for Food and Nutrition Education Provision in Schools

The Maltese islands are strategically located in the crossroads of the Mediterranean Sea, and this has led to the development of a food culture which is closely linked to its regional context, its dynamic history and its multinational inhabitants over the years. Food is a prominent element of everyday discourse in Malta, though perspectives on its link to individual, community and regional well-being differ and valorisation and actions in this regard are varied. Education for food and nutrition and healthy eating is seen by some as restrictive rather than emancipatory in nature, and only recently have different pockets of society and some policymakers started to perceive it as a vehicle for achieving well-being beyond the prevention of disease.

Using the Mediterranean diet as a context for FNE has been proposed in different fora, given that this diet lends itself to explore and use food within four dimensions of sustainable development: health, environment, economic and social-cultural (Dernini et al., 2017). By placing FNE in a Mediterranean diet framework, an integrated and holistic programme can be developed which will allow for the different thrusts required by the different school subjects, but will simultaneously be cohesive and comprehensive. The FNE can be created and facilitated to align with students' developmental stages and interests, thereby increasing potential for meaningful and long-lasting assimilation and application in different life, play and work settings. The rudimentary mapping in this chapter and elsewhere (Piscopo, 2017a) of where and how FNE is delivered across the current syllabi and programmes has shown a somewhat fragmented picture, with an apparent lack of alignment within years and across subjects and with some repetition in the different subjects. At the same time, it is evident that efforts are being made to highlight not only the health aspects of FNE but also cultural and environmental and economic concepts and actions. In some cases, these are necessary elements of the subjects being taught. Thus, a Mediterranean diet framework can be a unifying vehicle where

FNE for personal life skills, responsible citizenship and future employment coincide in a harmonious programme with the ultimate goal of enhancing well-being and quality of life of Maltese food consumers and producers and of Maltese citizens and visitors to the islands (Dernini et al., 2019; Piscopo, 2017b).

Conclusion

The Maltese national curriculum (2012) emphasises the importance of students being equipped 'with the necessary knowledge, competencies, skills, attitudes and values which they need to maintain, promote and enhance physical, emotional, psychological and social wellbeing throughout their school life and as lifelong learners' (p. 35). FNE is unequivocally a requisite component of this entitlement and is already provided for in myriad school subjects at different levels of compulsory schooling and beyond. Yet it is also evident that Malta needs a more structured approach to FNE within an integrated framework. The Mediterranean diet is being proposed as one possible framework to harness. Using the Mediterranean diet and its four sustainability dimensions could allow for students and educators to make linkages across subject boundaries and engage more meaningfully with FNE. It can also promote more theme and team teaching, to replicate the realities and complexities of the world beyond the school walls. As an island in the Mediterranean Sea, Malta can lead the way in this endeavour with the potential for regional adaptation in neighbouring nations.

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Chapter 8
Home Economics Education in Secondary School Settings: Lessons from Education Policy on the Island of Ireland

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Abstract Home Economics education aims to provide a comprehensive, applied and practical experiential learning environment for studying food education. This chapter will discuss Home Economics secondary school education in two jurisdictions on the Island of Ireland—the Republic of Ireland and Northern Ireland. The educational rationale, aims and underlying pedagogical approaches to teaching Home Economics in educational policy in both jurisdictions will be explored and comparative case study similarities and differences highlighted. The Home Economics curricula at secondary schools vary between jurisdictions and this provides the basis of the analysis. The chapter concludes by detailing how Home Economics education can contribute to the systematic development and practical application of food skills, knowledge and competencies.

Keywords Home economics · Curriculum · Food education · Cooking · Island of Ireland

Introduction

The International Federation for Home Economics (IFHE) states that Home Economics "is a field of study and a profession, situated in the human sciences that draws from a range of disciplines to achieve optimal and sustainable living for individuals, families and communities" (IFHE 2008, p. 1). Although the preferred name for the discipline and the profession is Home Economics, there are many variations used on the name

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internationally, including Family and Consumer Science (USA); Human Ecology (Canada) and Home and Consumer Studies (Sweden). As a curriculum area, Home Economics "facilitates students to discover and further develop their own resources and capabilities to be used in their personal life" (IFHE, 2008, p. 2). Internationally, it is widely accepted that Home Economics teachers are responsible for teaching food education to young people in schools. Home Economics, for many, is the subject on the curriculum responsible for teaching students food knowledge, skills and attitudes required for life. Through the subject, students have an opportunity to develop transferable skills to be adaptive and respond to everyday food and health issues. Pendergast (2012) notes that the value of Home Economics is that it "does not teach a skill for the sake of that skill, it teaches for application, it teaches informed decision making in endless scenarios, it teaches evaluative and critical thinking skills, it empowers individuals—no matter what their context" (2012, p. 8).

This chapter explores Home Economics secondary school education in two jurisdictions on the Island of Ireland—the Republic of Ireland (ROI) and Northern Ireland (NI). In both the ROI and NI, the name Home Economics is used on the curriculum and in teacher education. The chapter examines how Home Economics education in the secondary school setting contributes to the systematic development and practical application of food skills, knowledge and competencies. The use of the two jurisdictions allows some cross case study analysis to be carried out (Thomas, 2011).

The Island of Ireland comprises two jurisdictions—the ROI and NI—with each having separate governments. The Department of Education and Skills (DES) in the ROI has overall responsibility for the curriculum and educational policy in all schools. The National Council for Curriculum and Assessment (NCCA) develops new curricula for approval by the Minster for Education and Skills. The Department for Education, Northern Ireland (DENI), has responsibility for educational policy in schools although similar to the Republic; this is developed by the Council for Curriculum, Examinations and Assessment (CCEA) and is based on the National Curriculum used in England and Wales. The curriculum in Northern Ireland schools aims to "empower pupils to achieve their potential and to make informed and responsible decisions throughout their lives. It is about helping pupils prepare for life and work as individuals" (CCEA, 2007, p. 2).

In the ROI, a recognised teacher education qualification, along with education to Degree level in the discipline Home Economics, is required in order to register as a Home Economics teacher with the Teaching Council. Currently, in order to gain registration, students study a 5-year programme which comprises Bachelor of Arts Home Economics and Professional Masters in Education (with Home Economics). This includes students studying the discipline Home Economics and the pedagogy associated with teaching the subject. The Teaching Council in Ireland recognises this Degree for registration as a Home Economics teacher. Whereas, in NI, no university offers students an opportunity to study the discipline Home Economics for their undergraduate degree. Where a student aspires to becomes a Home Economics teacher, they must undertake a 1-year Post Graduate Certificate of Education (PGCE) in Home Economics that focuses on studying education as opposed to Home Economics disciplinary content. However, the University of Ulster entry requirement for the PGCE (Home Economics) refers to the applicant normally having an honours degree in Home Economics or in the event of a combined degree, at least 50% shall be in the subject Home Economics. This requirement is in place despite there being no such University course available in NI. Consequently, the qualifying degree for entry to this programme can be from a number of allied areas to Home Economics such as Food and Nutrition, Consumer Studies, Consumer Management and Food Innovation.

Home Economics Education in the Republic of Ireland

In the ROI, the name 'Home Economics' is used to describe the subject across the education system at all levels, including post-primary (secondary) and teacher education. Home Economics has a long history in the Irish education system dating back to the early 1800s in Irish primary schools (McCloat and Caraher, 2018). In secondary schools, Home Economics is an optional subject on the curriculum. It is available at both Junior (aged 12–15) and Senior (aged 15–18) cycles. Although the subject is optional, it remains consistently a popular choice among students.

At junior cycle, the uptake of Home Economics has remained consistent over the last 3 years where 36% of the total number of junior certificate students study Home Economics (Table 8.1).

Although at senior cycle there are significantly less students studying the subject, mainly because students do not choose as many subjects as in the junior cycle, the total cohort for the last 3 years has remained consistent at 21% (Table 8.2). Consequently, the subject remains one of the most popular optional subjects chosen by students.

Table 8.1 Junior certificate home economics (Author, adapted from State Examinations Commission, 2016, 2017 and 2018)

Year	Total number of junior certificate students	Number of students studying home economics	As a % of total student cohort
2018	62,562	22,644	36
2017	61,654	22,257	36
2016	60,248	21,464	36

Table 8.2 Leaving certificate home economics (Author, adapted from State Examinations Commission, 2016, 2017, 2018)

Year	Total number of leaving certificate students	Number of students studying home economics	As a % of total student cohort
2018	54,396	11,558	21
2017	55,731	11,814	21
2016	55,684	11,642	21

Junior Cycle Home Economics

In September 2018, a new Junior Cycle Home Economics Specification was implemented in all schools for first-year students. This curriculum development took place in the context of an overall reform of the Junior Cycle programme offered in secondary schools (DES, 2015). The Junior Cycle Home Economics subject consists of a three-year course of study with a minimum of 200 hours timetabled student engagement. The new Specification for Home Economics identifies the subject as a field of study, which aims to achieve "optimal, healthy and sustainable living for individuals, families and society" (DES, 2017, p. 4). Through engagement with Home Economics at junior cycle, students develop their knowledge, attitudes, skills, understanding and values to achieve this approach to living. From a food education perspective, Home Economics aims to "develop students' practical food and health literacy skills so that they are enabled to adopt a healthy lifestyle and make informed decisions that positively impact their health and wellbeing as individuals as well as within their families and society" (DES, 2017, p. 5).

The learning outcomes for Junior Cycle Home Economics are arranged in three inter-connecting strands which include: Food, Health and Culinary Skills; Responsible Family Living; and Textiles and Craft. Although the learning outcomes are set out under each of these strands, teachers are advised to encourage a fully integrated experience in order to maximise student engagement and learning. This integrated nature of Home Economics is achieved by studying four crosscutting elements, including: Individual and family empowerment; Health and wellbeing; Sustainable and responsible living; and Consumer competence (Fig. 8.1, DES, 2017, p. 12).

Junior Cycle Home Economics is the only subject on the national curriculum that provides food education in a systematic and experiential way to students. The strand food, health and culinary skills aims to enable students to "develop a healthy, sustainable attitude and positive relationship with food through practical experiential learning" (DES, 2017, p. 10). A key strength is the practical, hands-on experience for students, underpinned by scientific and theoretical knowledge. The learning outcomes in this strand demonstrate the broad range of knowledge, skills, attitudes and values that are developed in the subject, including budgeting; shopping; food choice; menu planning; portion control; planning menus for diet related diseases and for families at various stages of the life cycle; healthy eating; nutritional analysis; food science; homemade vs. commercial food production; ethical and ecological food choices; food labels; food waste; and the practical skills of food preparation and cooking using a variety of techniques.

The experiential and practical pedagogical approach encouraged in teaching and learning Home Economics at junior cycle is reinforced by the assessment approach. At the end of the 3 years of study, students will be expected to apply their knowledge, understanding and practical food literacy skills, utilising a problem-based learning approach, to a number of scenarios. These scenarios will range from preparing a meal with due consideration to a special diet or diet-related disorder;

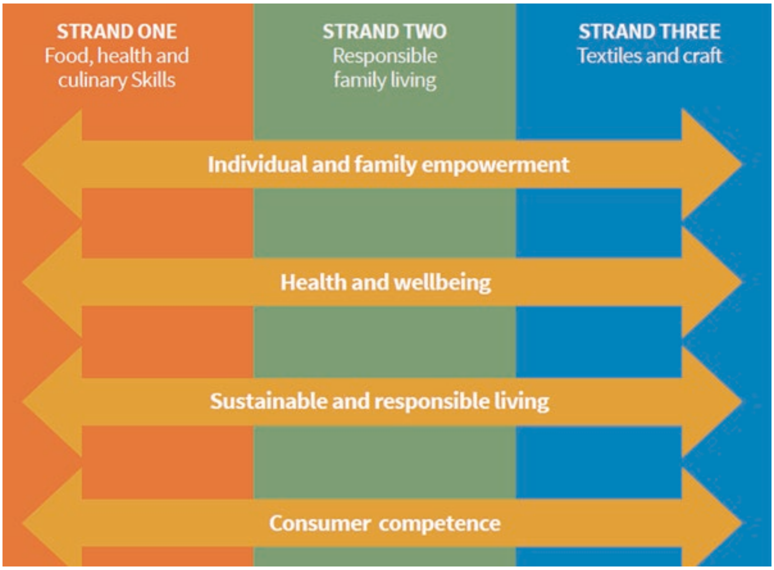

Fig. 8.1 The elements of the contextual strands (DES, 2017, p. 12)

cook a healthy family meal; prepare a school lunch; to resourceful cooking (DES, 2017). This practical assessment is worth 50% of the externally assessed marks with the other 50% assigned for a written examination.

Senior Cycle Home Economics

A revised senior cycle *Home Economics—Scientific and Social* for the Leaving Certificate was introduced in schools in 2002 with the first examination in 2004. The aim of the syllabus is to "develop the knowledge, understanding, skills, competence and attitudes necessary to contribute to a personal and family environment conducive to human development, health, leisure, security and happiness" (DES, 2001, p. 2). Home Economics at senior cycle is designed for 180 hours of class contact time over a period of 2 years, which is approximately five classes of 40 minutes per week, where a minimum of one double period (80 minutes) per week is required to facilitate practical work.

The syllabus is structured around three core areas and a choice of three electives (Table 8.3) with the majority of time being weighted towards food studies.

Building on Home Economics at junior cycle, students have the opportunity to study food literacy topics including: food choice; food science; nutrition; diet and health; preparation and processing of food; cooking of food using a variety of

Table 8.3 Structure of the leaving certificate home economics syllabus (DES 2001)

Core areas of study	% Weighting
Food studies	45
Resource management and consumer studies	25
Social studies	10
Electives (choose one area)	
1. Home design and management	20
2. Social studies	20
3. Textiles, fashion and design	20

techniques; food microbiology; sensory analysis; food safety and hygiene; nutritional analysis; preservation of food and food legislation. Teaching and learning in Home Economics at the leaving certificate level focuses on ensuring students will have the requisite skills and knowledge to "take control of their own lives at present and in the future" (DES, 2001, p. 2).

The assessment of leaving certificate Home Economics depends on which elective is chosen. For those who choose the first two electives (see Table 8.3), the written examination is worth 80% and the Food Studies coursework is worth 20%. However, for those studying the Textiles, Fashion and Design Elective, 70% of the marks are for the written examination, 20% for the Food Studies coursework and the Textile Studies Elective coursework is 10%. The Food Studies coursework requires students to complete four assignments from a prescribed list of five topics distributed each year. The topics can include specific diet-related disorders; nutritional topic; diet through the life cycle; sensory analysis and use of an appliance.

Home Economics Education in Northern Ireland

Home Economics is a mandatory requirement for all students (male and females) up to Key Stage 3 level (age 11–14 years) in NI. Students are required to study the subject within the learning area Learning for Life and Work as it is concerned with preparing young people for independent living (CCEA, 2017, p. 1). Students must study three key concepts in Home Economics: Healthy Eating; Home and Family Life and Independent Living. The key concept Health Eating affords students the opportunity to explore the concept of health eating and to develop knowledge, skills and understanding in the choice, planning, storage, preparation and cooking of food. Similar to the Junior Cycle Home Economics programme in the ROI, there is a strong focus on practical food skills which is underpinned by theory. According to CCEA (2017), students acquire "knowledge, understanding and practical skills in areas such as diet and food choice, family relationships and parenting and financial and consumer awareness" (p. 1).

GCSE (General Certificate Secondary Education) Home Economics: Food and Nutrition

Home Economics, as a GCSE subject area, develops pupils as an individual member of society by "helping them explore their health in a practical context, enhancing their potential to live a healthy lifestyle and make responsible choices about their diet and food" (CCEA, 2007, p. 2). If a student chooses to continue to study Home Economics after Key Stage 3, they can opt for the revised GCSE (General Certificate Secondary Education) Home Economics: Food and Nutrition Specification, which commenced in September 2017. The specification has a class allocation of 120 hours and comprises two areas: Food and Nutrition and Practical Food and Nutrition. According to CCEA (2017) the topics include: nutritional guidelines; food science; nutritional and dietary needs of different groups of people; food provenance; food production and processing; food safety and utilising a variety of food preparation and cooking techniques. Similar to the ROI, the assessment of GCSE Home Economics: Food and Nutrition has a 50% weighting for the practical skills examination that "develops unique transferable skills" (CCEA, 2016, p. 15). Students are assigned a practical task which can involve them preparing three dishes plus accompaniments to meet the requirements of the task assigned.

GCE (General Certificate Education) A Level Nutrition and Food Science

The name Home Economics is not used to identify any subject at senior cycle in NI. However, if a student wishes to continue their food education to GCE A Level, they study a subject called Nutrition and Food Science, which was revised in September 2018. The student has the option of taking the course as Advanced Subsidiary (AS) as a final qualification, which has a guided learning allocation of 180 hours. However, if they are taking the course for full GCE A Level qualification, they will be required to have 360 hours of learning and will also complete additional units of learning. The course of study is theoretical with no practical work included as a mandatory component. The core areas of learning are in Principles of Nutrition, and Diet, Lifestyle and Health with two additional units if students are taking the course to GCE A Level (Table 8.4).

Discussion

What emerges from looking at the provision of Home Economics in secondary school education in the ROI and NI is that there are similarities in terms of underpinning pedagogies and curriculum at junior level, but also differences in terms of

Table 8.4 Nutrition and food science specification (Author, adapted from CCEA, 2018)

Content	Assessment	Weighting: Advanced subsidiary (AS)	Weighting: GCE A level
AS 1: Principles of nutrition	External written examination	50% of AS	20% of A level
AS 2: Diet, lifestyle and health	External written examination	50% of AS	20% of A level
Additional units for GCE A level			
A2 1: Option A: Food security and sustainability ***OR*** Option B: Food safety and quality	External written examination	N/A	30% of A level
A2 2: Research project	Students complete a 4000-word research-based project	N/A	30% of A level

support, specialist training and the practical implementation of policy solutions. Some of the differences in support issues can be found in the training provision for Home Economics teachers. Up until 1922 the island of Ireland shared a common educational policy; with the advent of the Irish Free State in 1922 the administrations separated; there were many similarities and overlaps in the early years of this separation but we are now seeing the emergence of major differences (McCloat and Caraher, 2018).

Home Economics in schools in the ROI and NI is a platform for teaching a sustainable and healthy approach to food and living. It promotes developing a positive relationship with food whilst maximising practical experiential learning and availing of opportunities to make the learning real and applicable to everyday life. As is evident from both curricula in NI and the ROI, Home Economics is a comprehensive subject sequentially integrating aspects of nutritional knowledge, scientific theory and practical food skills. Internationally, there are frequent calls to teach people how to cook (McCloat et al. 2017; McGowan et al. 2017; Caraher and Seeley, 2010; Vileisis, 2008). Alongside this, the media lament a perceived demise of cooking (Murcott 2012, 2019). These calls for more cooking often translate into calls for cooking in Home Economics (Owen-Jackson, Rutland, 2017), reducing Home Economics to a single issue focus, ignoring the wider role of Home Economics and the expertise required to deliver it (see these as examples of this tendency to reductionism: Jamie Oliver Foundation 2017; British Nutrition Foundation 2017a). Nonetheless, teaching people technical cooking skills in isolation will not provide them with the required knowledge, understanding and skills to navigate the myriad of food environments. Such piecemeal interventions are often not sustainable and not effective over a period of time (McCloat and Caraher, 2016; Caraher et al., 2010; Caraher and Reynolds, 2005). Instead, having an established and comprehensive curriculum such as Home Economics, with specialist trained teachers, can approach the teaching of food education in a systematic and integrated way. This is further reiterated by Wolfson et al. (2017) who identifies cooking as a complex process and calls for an intervention framework developing 'food agency' which gives due cognisance to the multifaceted nature of food management, skills and knowledge.

Home Economics, as a subject on the curriculum, provides this multifaceted, multidisciplinary approach to food education. McGowan et al. (2017) concluded a necessity for programmes to be multifactorial, which integrate a range of knowledge and psychology-related factors in their design. Consequently, Home Economics in schools is the most favoured and coherent place to teach comprehensive food literacy skills to students as it incorporates a practical and theoretical component (Ronto et al., 2016; Burton and Worsley, 2014). In order to develop a confidence in choosing, preparing and cooking food for themselves and their families, students need to be taught the scientific and practical aspects of food as part of a comprehensive curriculum; this is about equipping them with the critical skills for adulthood and the various roles we play in our health and life careers (Lichtenstein and Ludwig 2010; Robertson and Schneidler-Benns, 2015). In a longitudinal study, food preparation behaviours were tracked over a 10-year period and they resulted in greater engagement with food in early adulthood (mid to late twenties) but not during adolescence (Laska et al. 2012). This suggests that skills acquired early on may well be used later at key 'life-career' points. The success of this is evident: Worsley et al. (2015) found associations between Home Economics education in schools with higher levels of food knowledge across several age groups in a study in Australia. Whilst Lavelle et al. (2016) identified that learning cooking skills as a young person is positively related to cooking and food practices, cooking confidence, health and diet quality in later life; and consequently, recommending "high quality practical food education" is provided in schools (p. 9).

The benefits of Home Economics education in developing essential food skills and contributing to public health was brought to the fore internationally by Lichtenstein and Ludwig (2010), who argued that food education has an important part to play, as a component of a long-term solution, to addressing dietary habits of young people. Consequently, they identified mandatory food education and 'bringing back' Home Economics as one of the best investments that society can make (Lichtenstein and Ludwig, 2010). In both jurisdictions outlined in this chapter, Home Economics is the subject on the curriculum that facilitates students to develop knowledge, practical skills and understanding in relation to food. Students have an opportunity to apply this knowledge and understanding in a practical, hands-on cookery class whilst developing their cooking self-efficacy in a holistic way. Where Home Economics as a subject or profession does not exist, people look to other ways of including key food skills in the curriculum or in an out-of-class situation as in Condrasky's (2010) culinary nutrition or 'chefs adopt a school'-type programmes (Ballam, 2018; British Nutrition Foundation, 2017a, 2017b; Jamie Oliver Food Foundation, 2017; Caraher et al., 2013; Caraher et al., 2010). While programmes such as the those run by the British Nutrition Foundation, Food for Life and the Food Teachers Centre offer some additional short-term training on food education for teachers in the UK, they are optional and often exist outside the requirements of the formal curriculum. While promoting a whole school approach, this has to be negotiated on a school-by-school basis and is not embedded in curricula or pedagogical approaches.

In reviewing the curriculum content for Home Economics across both jurisdictions, a broad range of common underpinning knowledge, scientific principles and practical skills are evident. The main differences between the two curricula are the topics which are covered. In the ROI, Home Economics comprises areas including food studies; textiles, fashion and design; and family resource management. However, in NI the curriculum focuses solely on food education but over a shorter number of contact hours (120 hours (NI) vs 200 hours (ROI) at junior cycle). Common food themes in curricula include nutrition; food science; menu planning; food provenance; shopping; budgeting; food safety; nutritional and dietary needs of different groups of people; ethical and ecological food choices; practical skills of food preparation and cooking using a variety of techniques. This broad base for the curriculum is a strength for the subject. Indeed, Condrasky and Hegler (2010) state that programmes focusing on producing "sustainable healthy eating behaviour through culinary confidence and nutrition alertness are a successful approach to begin the restoration of our nation's health" (p. 1).

Despite the comprehensive food education provided through Home Economics on the curriculum, a difference exists between NI and the ROI on whether or not all students are required to study the subject. In 2007, the Department for Education, Northern Ireland (DENI) prioritised the studying of Home Economics on the curriculum and made the subject compulsory for all students up to Key Stage 3. Baird (2010) identifies this area of the curriculum as one of the most important for students to learn in the current era because of the knowledge, skills and understanding it teaches in relation to food. Nonetheless, for NI the challenges are located in the facilities available in schools to teach the subject and the shortage of specialist teachers. In the ROI, it remains an optional subject despite numerous calls to make is compulsory (Hickey, 2018; Boland, 2017; Maguire, 2017; Sweeney, 2015; Gray, 2015; McCloat, 2012, 2013). However, the publication of the Report of the Joint Oireachtas Committee on Childhood Obesity in November 2018 has heralded a significant shift in attitude towards Home Economics by policy makers. The Report recommends making Home Economics compulsory, on a phased basis, for the Junior Cycle curriculum in secondary schools in the Republic of Ireland (Houses of the Oireachtas, 2018). The publication of this recommendation follows evidence presented to the Houses of the Oireachtas in May 2018, which called for compulsory Home Economics, by numerous witnesses giving evidence at the hearing of the Committee (St. Angela's College, 2018; ATHE, 2018; Safefood, 2018). Primarily, the recommendation was made in light of the necessity, from a public health perspective, to teach young people practical food education and in particular, practical food and cooking skills. It remains to seen whether or not the recommendation will be implemented in the coming years.

A constructivist approach to teaching and learning is the pedagogical approach Home Economics curricula in both jurisdictions. Home Economics education adds the active dimension to learning that requires students to think critically and reflectively about the content and the process. Consequently, students' level and complexity of thinking about food and health issues can increase (McCloat and Caraher, 2016). Similarly, Ronto et al. (2016) notes that the comprehensive, hands-on approach in Home Economics education ensures the subject is well positioned to develop students' food literacy skills. The pedagogical approach utilised in Home Economics education in both the ROI and NI facilitates the subject to play a key role in developing practical and theoretical food competencies in young people. The application of scientific and theoretical knowledge, understanding and skills in practical real-life food situations is an inherent pedagogical approach to teaching and learning in Home Economics and aims to facilitate students to have a positive relationship with food.

What remains clear in broader health promotion literature on healthy eating is that there needs to be congruence between what is practiced and what is taught in schools (Townsend et al. 2011). Therefore, the promotion of healthy food habits in Home Economics needs to be matched by the provision of food in the school setting. This can be achieved in NI, as like the rest of the UK, there is school meal provision, which is not the situation in the ROI. There is in England, Scotland and Wales nutrition standards for school meals. As we noted above, single-issue approaches such as the equation of home economics with cooking solely, or as Owen-Jackson and Rutland (2017) termed it 'from cookery to cookery', are inadequate; likewise Home Economics needs to be located within a broader framework of healthy schools work. This framework is more evident in NI with its support for school meals and food-based initiatives whereas the ROI has strong support for Home Economics.

Conclusion

This chapter has provided insight into the Home Economics curricula, focusing specifically on food education, in both the Republic of Ireland and Northern Ireland. By exploring the rationale, aims and pedagogical approaches to teaching Home Economics on the island, it is evident that Home Economics education contributes to the systematic development of students' practical food skills, knowledge and competencies. The Home Economics curricula, in both jurisdictions, is a comprehensive and wide-ranging programme incorporating scientific theory, nutritional knowledge and practical food and cooking skills taught in an experiential, sequential and integrated approach. It is an established subject on the island of Ireland which is evidentially well regarded as a compulsory subject on the Northern curriculum and a policy recommendation now in place to make it compulsory in the Republic of Ireland. The pedagogical approaches and philosophical underpinning in the Home Economics curricula on the island ensures the subject is ideally placed to deliver a holistic, multi-faceted and comprehensive food education to students aiming to prepare them to navigate everyday food circumstances and develop a sustainable healthy approach to, and relationship with, food.

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Part II
The Professional Identity of Food Teachers

Chapter 9
Positive Ingredients to Redefining Food Education in Schools in New South Wales, Australia

Donna Owen

Abstract Reflective teaching based on past, present and future experiences and the motivation for teaching food education becomes increasingly relevant as the profession evolves within the framework of curriculum changes and trends currently impacting on food education in Australian schools. As food educators, we should be concerned about current issues and problems relating to food security and sustainability not just on a national level but also on a global scale. If students are to understand and solve problems for the future, we, as the teachers, need to lead the way in widening their view and utilise food as the subject area to achieve this. As a result, the focus of this chapter is to draw upon research and surveyed reflections from current food teachers as a lens to unpack the key influencing factors that will keep food education evolving and relevant for the next generation of students and teachers.

Keywords Teacher influence and identity · Food education relevance
Curriculum changes · Flexible professionalism · Agents for change

Food Education in the Australian Curriculum

Food in the Australian curriculum has evolved with the educational needs that existed at different times throughout Australian history (Street, 2006). Turner (2012) further supports this argument stating that food taught in the curriculum began in the 1800s with the evolution of the subject influenced by government policy. Historically, the curriculum content was reflective of the perceived needs of society of this era. Williams (2006) examines this perspective stating that technology-focused subjects developed from Home Economics and Industrial Arts foundations. Furthermore, the point is highlighted that there are teachers who still place greater value on

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technical skills rather than innovative approaches that are adaptable and fluid to the needs of the new generation of food students. It is important therefore that current and future food teachers go beyond these historical patterns of thinking and remain flexible in their teaching approach, to foster students to think critically about broader issues in society.

It is timely that as food educators in Australia it is with a collective focus that we can work together to ensure food as taught in the curriculum remains relevant to students. Currently, schools across Australia are in the early phase for delivering the new national curriculum for stage 4 (Years 7–8) and stage 5 (Years 9–10). Within this context, food education is taught within the key learning area of the Technologies, which can be further broken into two streams: Design and Technologies and Digital Technologies. For example, students by the end of Year 8 across Australia will have the opportunity to study Food and Fibre production as one of four contexts that teachers can deliver under Design and Technologies. For stage 5, teachers will still be able to draw on further deepening student food literacy by exploring further with Food and Fibre production, with the addition of food specialisations to the curriculum, which can also be delivered to enable teacher flexibility across different schooling contexts across Australia (ACARA, 2012). For senior studies across Australia, food electives are offered to suit the individual needs with the state or territory. The course delivered in New South Wales is Food Technology. The rationale document for the Food Technology syllabus (Board of Studies, 2009) highlights the importance that food is relevant and essential to life and that food issues should be reflected throughout the Preliminary (Year 11) and HSC (Year 12) Food Technology courses. The emphasis on teacher influence delivering food in the curriculum cannot be understated; Turner and Seemann (2010) support this argument, emphasising the importance of teachers drawing on real-world contexts to address problems surrounding global food issues and to ensure relevance of the course content delivered to students.

Key Food Technology Teacher Qualities

Through a review of research (Dixon, 2016; McGregor, 2016; Owen-Jackson & Rutland, 2017; Trevallion et al., 2013; McKim et al. 2015; Pittia, 2015; Määttä and Uusiautti, 2012; Pendergast & Dewhurst, 2012; Williams & Williams, 2011; Holden, 2010; Turner, 2010; Moyle, 2010; McGregor et al., 2008; Street, 2006; Banks et al., 2004; Rosiek, 2003; Hoy, Sweetland & Smith, 2002; Kunkwenzu, 1997; Shommo, 1995), key qualities that food teachers will require in order to maintain relevance and growth when teaching current and future students have been identified. The significant themes discovered through conducting this research relates to teacher identity and interpretation of food content in the syllabus. They are responsiveness to student learning needs, continually evolving current professional knowledge and the importance of teachers remaining flexible and open to changes in the future.

My interest in surveying current teachers delivering food education in Australian schools led me to use the online tool Survey Monkey to allow the respondents to remain anonymous as they answered ten questions, framed to gain a better insight into what current teachers know through their individual experiences in schools. Teachers were asked to reflect on their understanding of the subject area they teach, to draw on their own personal experience as a food teacher and relate the key factors that influenced their decision to become a food teacher. Other focus areas included the knowledge and skills they focus on developing in their students and how they themselves remain innovative in their teaching approach. The survey link was posted on Facebook in three different Food Technology group pages. The decision to use social media as a vehicle to collect data from teachers who deliver food subjects in schools was useful to gain a wide perspective, as any teacher from across Australia can become members of these social media groups. Although only 20 teachers participated in the survey, their insight in conjunction with relevant research brings a wealth of positive ingredients collected from teacher perceptions and perspectives to be analysed alongside relevant research. The geographical locations of the teachers who completed the survey are unknown; however, the knowledge shared from the participating teachers gives an insight into their personal experiences as a food teacher in the Australian school context. Goddard et al. (2004) draws on social cognitive theory as a lens to explain teacher agency and the influence of a collective group with similar beliefs on an individual's beliefs. Social media via Facebook enables food teachers across Australia to connect and share ideas and resources. The first theme explored from the survey results and research was the importance of teacher identity and the impact of this on future decisions made in the classroom.

The Importance of a Food Teacher's Identity

Teacher identity is an important factor when determining the impact on student achievement and, more importantly, how this frames student perceptions in what they are learning. "Teachers represent what they teach and they are part of the subject they teach" (Määttä & Uusiautti, 2012, p. 28). It is this combination of individual personalities, educational background and career paths followed that form the 'personal constructs' developed uniquely in each teacher (Banks et al., 2004, p. 144). Professional knowledge of food teachers is formed by their personal beliefs and the overarching purpose they assign to teaching food subject to their students. When asked the question what were the influencing factors that led to their decision to be a food teacher, 25% of the survey respondents stated that it was the teacher that they had in school that inspired them to also become a teacher in the same field. One example of this is the link that Respondent Eleven makes to the passion felt for the subject due to "… great teachers who inspired my interest in this area".

Määttä and Uusiautti (2012) highlight the importance of the teacher as an influencing factor with the ability to make a substantial and positive impact on the students they teach. Teaching is a complex activity, which needs to go beyond a theoretical focus to inspire student commitment, "… it is about discovering ourselves in relation to new ideas. It involves surprise, revelation, delight, and sometimes outrage" (Rosiek, 2003, p. 399). Indeed, Respondent Fourteen supports Rosiek's statement aligning with the following response, "I loved the creativity and the relevance … each lesson there was a new opportunity to excel or try something different and so much of what I learnt has been relevant in my life". Building on this sentiment, Respondent Fourteen goes further. "I had the most incredible teacher. She was deeply passionate about her subject and her students. She grabbed our attention and held it for the entire lesson. Her content was relevant, her examples enjoyable and she had excellent subject knowledge". Määttä and Uusiautti (2012) support this line of thinking, stating that teachers need to be able to reinvigorate their pedagogical knowledge and identity in order to provide students with variety. These teaching strategies may come in the form of utilising research, experiments and the ability to evaluate larger problems in the world by bringing this into sharp focus for students within a food context. It is by adopting this approach, which enables the widening of students' view of the world beyond the limitations of the classroom. How a food teacher frames and expands their knowledge will also affect how they interpret and deliver the curriculum to their students.

Teacher Interpretation and Relevance of Food in the Curriculum

Historically, food in the curriculum has been shaped from Home Economics and Industrial Arts Foundation. The question remains: has food education evolved with the times or are we as the teachers still influenced by how food was delivered in the past and replicating how food was taught to us to the next generation of students? One of the survey questions asked teachers to explain their understanding and relevance of food as a subject in the curriculum. Respondent Two stated, "Food Technology includes the place of food in our lives, on a personal level, a historical level, nutritionally, culturally and includes the industry generated by the agricultural, manufacturing, marketing and promotions sectors." Here this teacher supports the significance of food in the curriculum to both the individual and society. Pendergast and Dewhurst (2012) support this by stating that food is central to all aspects of human survival, belief systems and the environment. Delivering food in the curriculum from this viewpoint enables multiple perspectives of food issues to be critically considered and explored in the classroom.

Respondent Fourteen adds a deeper insight to the importance and relevance of contemporary food courses to student lives affirming that they should be given learning opportunities that encourage "… a really deep look at the foods we consume and the impact it has on the body, society and the environment". However, we as teachers need to avoid interpreting food in the curriculum as simply a mechanism to focus on developing practical skills and nutrition knowledge. For example, Respondent One states that food education is "learning about cookery methods and nutrition in a safe manner". Being aware of this as teachers is key to moving beyond notions of the past of how food should be delivered to future students. Kunkwenzu (1997) links teacher choice and action to their perception of the key themes interpreted from the subject content. It is important therefore that teachers continue to drive change by fostering 'global competence' in their students and prepare them for future employment (Dixon, 2016, p. 10). Trevallion and Owen (2014) support this, stating teacher perceptions of food as taught in the Australian curriculum should evolve with the changes generated from technological advancements and globalisation.

The ability to move beyond these traditional teaching methods of the past relies on food teachers remaining flexible and critical of the way food education is delivered to students. Teacher interpretation is pivotal, whereby teachers must examine the focus of the subject area and collectively agree on key capacities for students studying the subject beyond a 'practical skills' fixed mindset (Owen-Jackson and Rutland 2017). Holden (2010) elaborates further, stating that teachers should regularly question routine practices and view their teaching from multiple perspectives in order to remain open to change and continue the evolution of their teaching skills and knowledge in this subject area. Food teachers need to adopt a flexible mindset as a way to achieve professional growth throughout all stages of their career.

Flexible Professionalism

It is important as a teaching community that we remain flexible in our approach. According to Pittia (2015), teachers need to include the skills and competencies relating to entrepreneurial and innovative approaches in order to equip the new generation of food technologists and scientists. In this fast-paced technological era, Flynn et al. (2013) discusses the difficulties in predicting the ever-evolving skills required in a constantly changing industry. According to Jideani and Jideani (2010) key skills for people working in the food industry include food safety knowledge, understanding of food processing and productions systems. Critical thinking and problem solving skills are also necessary and should be combined with the ability to apply mathematical skills across a range of different contexts. Adopting a flexible professionalism will enable the subject area to remain relevant to the students. Trevallion et al. (2013) states that we need to continually reimagine how we equip students for life beyond the school. Indeed, Holden (2010) further supports this argument stating that teaching is becoming more complex and dynamic in nature. Food teachers now need to develop increasingly complex skills in students, which are multifaceted, and implement a range of methods, which give the learner the opportunity to solve real-world problems. According to ACARA (2012), through the Australian Curriculum, the key learning area of the Technologies has the potential to build key competencies in students. This should link entrepreneurial capabilities, the adaptability to use a range of different technologies and to foster creativity to enable students to strive continually towards being innovative. Students will need to further develop their critical thinking and collaborative and problem-solving skills to contribute effectively in the era known as the ‘knowledge-based economy’ (ACARA, 2012, p. 3). In addition to these overarching goals, food as taught in the secondary school context should be utilised more effectively as the mechanism to foster these key competencies and knowledge, in order to prepare and better equip students to cope with the ever-changing landscape of the modern workplace.

When asked in the survey “what skills, knowledge and personal strengths do you draw on when you teach food”, Respondent Eleven linked intrinsic motivation and the passion to pass on knowledge to their students and most importantly, to foster curiosity in food science. Ultimately, it is encouraging students to become autonomous learners and to see the work they are undertaking as meaningful (Rath, 2015). This teacher suggests involving students in the planning of practical experiences. Food lessons can be made richer by finding opportunities to develop student’s critical thinking skills. According to Moyle (2010), teachers need to create learning spaces, which enhance student agency and critical thinking abilities. Shommo (1995) supports this view, whereby incorporating problem solving as an effective teaching method to enrich a student’s understanding and learning in Food Technology. This is due to the many connections students can make within the classroom and most importantly externally, to larger global issues. Lawson (2012) investigated 120 students aged 11–14 regarding their perception of Food Technology. Problem solving as a technique used in Food Technology lessons was analysed in this investigation. From these results, it was discovered that problem-solving skills should be further developed in students and taught explicitly alongside global issues. Some of the issues that should be explored in the classroom relate to food insecurity, diet-related disorders, sustainable practices and conserving natural resources both in agriculture and food manufacturing.

Respondent Eleven achieves this through an intention to foster student interest in food and science by designing a learning environment in which they have an opportunity to experiment and take risks. Taking a flexible professionalism approach enables this food teacher to move beyond normative practices adopted in schools and, in turn, allows students to problem-solve from multiple perspectives. These are the skills that are valued in the industry and workforce. Indeed, Williams and Williams (2011) explain the benefits for students when they experience a purposeful connection with the work they undertake. This allows students to create, explore and make meaningful connections in these lessons. This notion of adaptability was also evident respectively in both Respondent Seventeen and Respondent Nineteen. One teacher argued that in the 30 years of their teaching experience, they found their knowledge needed to evolve with the many changes in the industry. Respondent Nineteen demonstrated flexible professionalism by undertaking research first whenever they teach a new concept to their students. This open mindset as supported by Hochanadel and Finamore (2015) states that intelligence is not static but can evolve with time. This allows the teacher to continue to expand their knowledge and in turn use their personal strengths of effective communication and research abilities to support and extend their students. McKim et al. (2015) further discusses the importance of balance between pedagogical competency over an extended period of time to ensure that teachers interrupt their routines in their practice and therefore become agents for change in their chosen fields.

Adopting a Transformative Approach as Agents for Change

To instigate change in current practice, teachers need to consistently work at not only transforming themselves, but actively take this approach to model change for the education system, which can both constrain and liberate them. The level of change needs to be significant to the point that a transformative approach is evident (McGregor, 2016). Holden (2010) discusses Huberman's five stages describing a teacher's career progression. In some cases, experiencing a small measure of discomfort in their teaching through adopting a transformative approach ensures flexible professionalism. This is achieved throughout each phase of their careers. In the early phase of the teaching career, the focus is on discovery and learning to cope with the workload. Later in the middle phase it is grounded by a level of stability which is achieved through experience. Two lines of thinking can come from this stage of the career progression: one is experimentation and engagement, and the other shrouded in self-doubt. This is often created from the day-to-day onslaught of the routines of teaching. The next phase is a sense of calmness, which stems from further experience and confidence in the classroom and finally in the last phase two pathways can be taken: (1) where a more conservative approach can be taken or (2) in which a sense of detachment towards all aspects of teaching is adopted. It is therefore important that food teachers be aware of the stages of career progression and how this can impact upon their ability to remain open to change.

To gain a better understanding of how teachers can achieve this, they were asked the question "please share some of the ways you innovate and bring about changes when teaching food in your school". Respondent Eleven wrote in depth regarding this questioning, giving an insightful account, which focused on career engagement and experimentation. This teacher wrote about incorporating the skills that the food industry value, such as the ability for students to experience opportunities to learn in a collaborative environment and build skills in problem solving. Furthermore, when delivering the Year-10 course this teacher also incorporates food science experiments, sensory testing and molecular gastronomy to assist student understanding of scientific concepts. It is clear from this that Respondent Eleven is not only focused on delivering required food outcomes from the syllabus document, but is also explicitly targeting valuable life skills relating to collaborative and problem-solving learning experiences also valued by the food industry. Food science concepts are explored through molecular gastronomy as an engaging and positive approach to open students to broader possibilities beyond the concept of just 'cooking'.

Food teachers should aim to keep their teaching practice in this phase of the teacher cycle similar to Respondent Eleven. The willingness to refocus is also evident with Respondent Eight's philosophy to change the limited view from cooking to really targeting the learning of the complexities of the science of food. Being aware of the patterns and limitations in current practice and finding more opportunities to instil in students a broadmindedness about food as a subject in the curriculum. This can only be realised if teachers are willing to disrupt normative practice associated with the history of this subject area within schools and choose to adopt a transformative mindset. Food teachers are in a unique position to influence the next generation of students. The aim should be to encourage them to follow a career path with food at the centre; however, this passion must be first fostered by equally motivated, innovative and flexible food teachers.

Even though the majority of responses made reference to the practical aspect of the subject, far more complex ideas were shared. Respondent Seven openly discussed their students' decision to study food, whereby some students were influenced by a 'genuine interest in food' whereas others have a scientific and academic interest. Finally, some students select to undertake food studies due to the perception of the ease of the subject or that they relate positively to the food teacher. Further perceptiveness from Respondent Fourteen said, "Food Technology is unlike any other subject due to the relevance of food in students' lives and the belief that students from a range of learning abilities can experience success in this subject due to the multiple ways that students can learn through visual, practical, and theoretical learning strategies". These reflections allude to the way students currently view food as a subject area which is multifaceted depending on the motivation underpinning the students decision to undertake this elective course in the first place. It is positive that students are exposed to the scientific aspects of food as a way to shift the one-dimensional view of food only taught through a cooking lens.

Food in the Australian Curriculum is different from other subject areas, as it enables students to draw on multidisciplinary skills and knowledge. This allows rich learning opportunities from multiple perspectives. Taking Respondent Eight's approach to make the focal point on learning about food and not about cooking in the early years is an essential way to counteract preconceived notions. This needs to move students beyond the perception that Food Technology only relates to food preparation, cooking and subject ease as compared to other disciplines taught in the curriculum. Turner (2010) further links the importance of students developing a goal-focused approach on leaving school, stating that Food Technologists' value being goal driven where researching skills and the ability to be innovative are vital for the continual growth of the industry. To support students to develop these skills, they should be taught explicitly how to sustain their energy and focus in order to be prepared for the demands of a fast-paced and ever changing society (Williams & Williams, 2011).

"Food Science and Technology (FST) is the timeliest and the most relevant professions of our time" (Jideani & Jideani, 2010, p. 4826). Their reasoning is that Food Science and Technology is the mechanism in which food availability, nutrition and food safety can be monitored and controlled. This is vital for maintaining the overall health and wellbeing of Australians. The link to timing relates to the changes in this era where technological advances have increased to the point where there is a need to deeply understand each phase of the food system. This includes understanding where and how food is grown, as well as the many stages of food manufacturing and processing before being distributed to Australian households. In the issues discussed previously, globalisation and the increasing pressures on precious resources require students to be discerning and critical users of information. Owen-Jackson and Rutland (2017) also remind food teachers on the importance of instructional clarity to ensure academic integrity in meeting the learning needs of three main groups of students studying food. That could potentially lead to career pathways in nutrition and dietetics, food science and hospitality and catering. However, with the increase in food issues related to food security and sustainability, there is a greater need for more students to follow careers as future scientists and technologists, who will need these skills and capabilities to address these wider global concerns.

Tian et al. (2016) highlights the importance of this problem stating that there is a major concern regarding the increase in demand for feed, fibre and food. Linking this to a continually expanding world population. Pendergast and Dewhurst (2012) support this direction, extrapolating that as a society we are far removed from food and agricultural production and yet, access to safe food supply is essential for longevity and health. The food and fibre production focus in the Australian curriculum is timely and an essential opportunity for food teachers to influence students to think more critically and broadly about these relevant issues impacting on the security of the world's food supply. This new direction allows young Australians to deepen their understanding of all the key factors involved in food systems from growing, producing and most importantly maintaining a high-quality and sustainable food supply. As a result, food teachers are in the position to foster further interest in students to follow into potential food-related careers in the technology field.

The discussion paper on The Australian Curriculum: Technologies elaborates on the importance of further training, career pathways and education in the technology field. There are opportunities in the curriculum for secondary students to specialise in technology subjects and potentially follow a career path into Food Science and Technology (ACARA, 2012). When asked the question "are there opportunities in your program for students to learn some skills utilised by a Food Technologist or Food Scientist in the industry", Respondent Seven demonstrated a willingness to forge links with the food industry, stating it would be beneficial to have food technologists and food scientists to come to the school to share their expertise with their students. This may be one solution for teachers that may not be confident taking this approach as suggested by Respondent Seventeen, who stated "I wouldn't know what to show them to teach explicit Food Technologist/Scientist skills". Respondent Fourteen follows this argument, elaborating that they are teachers and not Food Technologists. The additional compounding issue also remains that many food companies do not make it affordable, or accessible, for teachers to organise for their students to see first-hand what the industry would be like from a Food Technologist perspective. This is the reality for a large number of teachers; however, for any transformative thinking to occur, support for teachers needs to be given in order to instil confidence and belief that change is possible and opportunities to better equip students can continually be discovered.

An example of utilising industry expertise is evident in Respondent Eleven, whereby they shared their school's current involvement in the 'P-Tech Pilot' program. According to their website (P-Tech, 2018), this is known as the Pathways in Technology, a model enabling industry partnerships with schools where students have access to an industry mentor and can be involved in paid internships, work placements and opportunities for part-time work. These real-world industry connections can be developed when further study is undertaken by students after high school. This teacher discloses that their school has formed links with the University of Newcastle Food Science faculty, Agrifood groups on the Central Coast, CSIRO and food companies such as Sanitarium and Mars. In this program, students are mentored with additional opportunities to be involved in research and development activities and sensory evaluation testing. Guest speakers such as food stylists, food photographers and food scientists are organised to speak with the students, enabling real-world connections and authentic learning for students. The University of Newcastle Food Science faculty runs Food nutrition and food lab workshops where this partnership also mentors students undertaking food product development work. According to Johnston et al. (2014), this approach that this teacher has adopted is centred around creating learning experiences, which build key competencies in students relating to skills and knowledge aligning with the current needs of the industry. Finding opportunities for students to interact with and learn from industry professionals increases the learning experience and ultimately may lead to an interest in a food-related career (Pendergast and Dewhurst, 2012). If new generations of students enjoy the relevance of the subject, it is important that food teachers maintain their flexible professionalism and expose their students to learning opportunities that let go of what was done in the past and therefore maintain a transformative mindset for the now and into the future (McGregor et al., 2008).

Advocacy and the New Voice of the Modern Food Technology Teacher

Pendergast (2001) puts a strong argument forward that food as a subject taught in the turn of the century historically can never change. However, our understanding and interpretation of the past using a social, political and historical lens can serve as a reminder of the current issues and the possibilities to move beyond them in the future. There is a need to reframe what we currently know and decide as a teaching community what is important and relevant to impart to the next generation of students. According to Trevallion et al. (2013) for change to be realised, it is important for teachers to demonstrate a willingness to transform their own thinking and practice in order to continually evolve the way food as a subject in the curriculum is delivered to students.

Adopting a flexible mindset should be the catalyst that shifts colleagues and the general public perception of the importance of the subject taught in schools. When asked the question regarding how colleagues perceive food courses across the school, not surprisingly, the majority of responses candidly stated that the current perception of fellow colleagues still view the subject through the exceptionally narrow lens of 'cooking'. Common themes from this insight are clearly reflected in Respondent Four's comment, "Food Technology is still perceived by many staff members at their school as a non-academic subject". Respondent Three continues this argument and openly writes about the issue at their school, where the Principal does not value the subject area by allowing teachers from other faculties to teach classes who "have no idea or care about the curriculum and only want to cook fun food". Respondent Four further expands on this argument, stating that when the Food Technology teachers have the classes the following year, the students are often far behind needing to work hard to give students the required depth of knowledge and valuable learning experiences that honours the way Food Technology should be delivered. Rutland (2006) highlights the important aspects that food teachers should incorporate into their lessons. This can be achieved by ensuring academic rigour through discovering spaces to develop problem-solving and creativity skills. Most importantly, including interdisciplinary learning opportunities where concepts can be explored at a deeper level in the classroom.

From these responses, Dixon (2016) states it is therefore imperative that food teachers who are passionate about this discipline mutually work together. To reimagine a shared vision strong enough to generate a paradigm shift in the mindset of their fellow colleagues and principals. Respondent Twelve reflects over the challenge that many food teachers face on a daily basis from their colleagues stating, "I think that they feel we are not important at all and don't realise how many of the 21st century skills we cover on a daily basis". The importance of providing the school and the broader community with a consistent message of the relevance of this subject area in schools can only be realised if all food teachers adopt a unified voice that they can communicate with clarity within their schools (Trevallion et al., 2013). Hoy et al. (2002) goes further, linking the importance of building positive collective efficacy within a school, as an important tool in assisting teachers to question normative practice and ensure they remain open to the notion of continual transformation in their careers. Respondent Ten shared one example of a willingness to bring about change by adopting a persistent and advocacy approach, when defending the importance of food teachers and their ability to make significant contributions in their school. "I had to be pushy to get involved in the P-TECH program", which involved building industry partnerships with the food companies Mars and Sanitarium. Respondent Ten further describes the executive staff at their school only saw the link to IT and Engineering, and therefore it took grit and persistence for this teacher to become involved in this rewarding experience. Now, 'wonderful opportunities' were occurring for the food students in this school. It is from embracing a steadfast approach that food teachers are able to advocate the strongest standpoint to the relevant stakeholders. To communicate with clarity the importance of food delivered in the curriculum and the far greater contribution this subject area brings to student lives. This advocacy needs to also extend to the broader community. When asked a question pertaining to the perception of the wider community regarding the value of Food Technology in schools, Respondent Six made a strong argument, affirming "we as food teachers need to promote the subject better and make parents and students realise that food technology is a great subject".

Indeed, it does need to be collectively communicated that food taught in the Australian curriculum is reimagined beyond just the notion of cooking. Teacher agency becomes the strongest form of advocacy to campaign the benefits of this subject area to all key stakeholders. This needs to occur consistently and regularly in order to create opportunities for positive change to occur in the internal and external perceptions of how this subject area is perceived. This is imperative in ensuring that as a discipline it remains current and relevant to students. Teachers, therefore, need to be the driving force and agents of change for the future generations of students they teach.

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Chapter 10
Where Will Future Secondary Food Teachers Come from in England?

Sue Wood-Griffiths and Suzanne Lawson

Abstract This chapter asks 'where will future secondary food teachers come from in England?' It tracks the evolution of food teaching in the curriculum, tracing its origins in domestic science through to the present focus on food, nutrition and preparation. To answer the question it is necessary to understand the unintended impact and consequences of changes to the English school curriculum and the direct impact this has had on recruitment to initial teacher training. It is also necessary to understand the social impact of good food teaching within the context of the health of the nation and in particular children. To deliver a quality food curriculum in English schools we need skilled food teachers. The progression pathway through food education needs reinstating so that food teachers of the future can progress from General Certificate of Education (GCSE) for pupils aged 16 years, through Advanced (A) level for pupils aged 18 years, to subject-related degrees and on to teacher training. Without such a route, it is questionable that the subject can survive on the curriculum.

Keywords Food · Curriculum · England · Teacher training · Secondary

Introduction

This chapter will focus on how food education has evolved in English secondary schools in response to shifting political influences, alongside the changing landscape of initial teacher training to consider where future food teachers will come from. High-quality food education requires good teachers and a forward-thinking curriculum.

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The current crisis (in England) in recruiting secondary trainee teachers in all subject areas is severe. In 2015 the president of the Association of School and College Leaders (ASCL) indicated that schools were facing a 'perfect storm' in teacher recruitment (ASCL, 2015). This was due to increasing pupil numbers, entrants to the profession falling short of the numbers needed, a steady decline in the population of 21-year-olds from 2016 to 2022, meaning a smaller pool of graduates, and an economic upturn resulting in more graduate opportunities in the jobs market (ASCL, 2015). Their statistics applied to teachers of all subjects and phases. Recruitment of secondary food teachers is further challenged by the limited number of students studying a food-related degree and excellent professional job opportunities available in the food and beverage industry and hospitality sectors.

The food and drink industry is the biggest manufacturing sector in the country. The food supply chain employs almost four million people and generates over £112 billion of value for the economy each year (Food and Drink Federation, 2018). The demand for graduates with knowledge of food and the food industry is high for the sector and for teaching. An ever more competitive food and drinks job market possibly detracts graduates from contemplating teaching. It is acknowledged that the demands of the profession are particularly pronounced for new recruits (DfE, 2019a) as evidenced by the challenge of retaining early career teachers. Over 20% of new teachers leave the profession within their first 2 years of teaching, and 33% leave within 5 years (DfE, 2019a, p. 10).

This chapter will look at the shifting political focus on school-based food education along with the identity and purpose of the subject in schools. We will examine the unintended consequences and potential impact of the most recent changes to the English curriculum and qualifications framework on the supply of teachers for the future, and also consider how teachers might be trained.

Historical Influences on Food Education

Food as a subject in the English curriculum has its origins in the eighteenth century, with British Museum records tracing cookery in London schools to 1740 with food in the school curriculum originating back to 1840 (Rutland, 2006). Lawson (2013, p. 101) notes that food education at this point was 'practical, philanthropic and utilitarian' with the functional role of providing girls with domestic homeliness as well as skills for domestic auxiliary occupations. Educational reports, such as Howden in 1926, reinforced the teaching of food studies was mainly concerned with the development of cookery life skills 'with due regard to home conditions and the need for the economy' (Central Advisory Council for Education (CACE), 1926, p. 235).

The introduction of post-war secondary modern schools saw the rise of 'domestic science' as a key to restoring the health of the nation (Rutland, 2006). Teachers of this post-war era taught a curriculum differentiated by gender where 'house craft and needlework easily justified their place in the curriculum for most girls' (CACE, 1963, p. 389). By the mid-1960s domestic science evolved into home economics but the focus was still on girls preparing family meals in contrast to the male-dominated craft, design and technology (CDT) that provided boys with problem-solving skills when working with wood, metal and plastics. Teachers of the subjects tended to be female in home economics and male in CDT. Traditional barriers had begun to change during the 1970s when equal opportunities legislation (The Sex Discrimination Act, 1975) made it illegal to restrict subjects based on a gender divide (Geen,1989), but it was the introduction of the National Curriculum (Department of Education and Science (DES), 1990) that provided an opportunity for the two subjects to work together albeit in a sometimes inharmonious union.

As a subject, design and technology (D&T) was introduced in 1990 as a National Curriculum compulsory subject for pupils aged 5–16 years in England and Wales (DES, 1990) with different curriculums in Scotland and Northern Ireland where home economics has been retained. Revisions ensued in 1995 (DfE/WO, 1995), 1999 (DfEE/QCA, 1999), 2007 (QCA, 2007) and 2013 (DfE, 2013). The early years of the National Curriculum were challenging with many traditional home economics teachers feeling threatened teaching a subject that now had a technological and industrial context. Rutland (2006) notes that despite this unease many D&T departments did unite to develop a curriculum based on the design and technology fields of resistant materials, food and textiles technology and systems and control (DATA, 1995). Critics of the National Curriculum, most notably the engineering community, did not think food belonged in the D&T curriculum. Smithers (1993, cited in Fine 1994) considered that the inclusion of food in technology was more about keeping home economics alive and making technology ‘girl friendly’ than on its intrinsic value. The anti-food lobby argued that Technology was about making structures and artefacts with many food teachers fighting a dichotomy between the subject’s survival within technology and a desire to return to a curriculum focusing on practical skills, healthy eating and the function of ingredients.

The revision of the National Curriculum in 1995 simplified the prescribed programmes of study and reduced the attainment targets to two: designing and making (DfE/WO, 1995). In some schools this led to food teachers spending too much time on paper-based design activities, a situation that probably arose through traditionally trained home economics teachers lacking confidence in teaching design. In 1996, further guidance for teachers was published by the Department for Education and Employment (DfEE) and Ofsted, which sought to help schools implement food technology and define the characteristics of good teaching (DfEE, 1996).

Pressures on curriculum time meant that many D&T faculties often adopted a ‘carousel’ approach with pupils spending short sequences of time working in the different material areas. This resulted in limited opportunities for ‘practical’ cooking when the conflicting demands of developing design capabilities were prioritised over acquiring more practical skills. Criticism from Ofsted (2002, 2004, 2005) and demands to improve design skills led to some schools limiting practical experiences to sequences of short, focused practical tasks.

The Key Stage 3 National Strategy ‘Design and Technology framework and training materials’ (Department for Education and Schools (DfES), 2004) attempted to redress the balance of designing and making for pupils aged 11–14 years. It provided a broader definition of 'designing', offering food teachers innovative alternatives to drawing. Lawson (2013) notes that what was lost at the time was the realisation that designing with food was not necessarily about drawing. Rutland and Barlex (2006) also argued that designing in food should be concurrent with handling food, learning new skills to develop knowledge and understanding, a view supported by Owen-Jackson (2007), who argued that designing in food was better referred to as 'food product development' involving working with ingredients rather than drawing. The early years of the national curriculum was a confusing time for many food teachers as they battled with the identity of the subject.

Political Influences on Food Education

The battle regarding the identity of food education was not only happening in the classroom. In 2004, celebrity chef Jamie Oliver attempted to improve the quality and nutritional value of school dinners and recorded a short television series for Channel 4 that documented his critique of school meals and food education. This started the campaign 'Feed me better' (http://www.feedmebetter.com) to improve the quality of the food served in schools. In response to this campaign, the Department for Education and Skills set up the School Food Trust (2012) to advise on school meals, children's food and related skills. Its remit was to transform school food and food skills, promote the education and health of children and young people and improve the quality of food in schools. The need to adopt a whole school approach to what was happening in the classroom in food lessons to the food served in school was clear in this document.

The focus on food education and children's food in schools exacerbated the underlying tension as to whether or not food fitted into the D&T philosophy and curriculum (Lawson, 2013). Those who embraced the D&T curriculum argued that it made the subject interesting, gave currency and status and provided challenge. Those that wanted a more traditional approach to food education wanted to focus on teaching children to cook (Owen-Jackson and Rutland, 2017).

In 2006, a critical Ofsted (2006) report evaluating the effectiveness of food technology teaching within secondary schools responded to these concerns about food technology in the curriculum, 'that too little time is spent learning to cook nutritious meals' (Ofsted, 2006, p. 1). In its findings, the report noted that the key to success was effective teaching 'good and very good achievement tended to be associated with exceptionally skilful teachers and highly motivated pupils' as well as reporting that 'a shortage of specialist teachers restricted provision in a significant minority of schools' (Ofsted, 2006, p. 2). The recommendations of the report were extensive but of relevance here included the need to:

- 'clarify the relationship between the teaching of food as a life skill and the use of food as a medium for teaching design and technology'
- 'reconsider the demands made by the full spectrum of food technology in order to ensure that the subject meets the learning needs of all pupils'

- ‘identify precisely the shortfall in teacher supply and take steps to train specialists, including those with industrial experience in food technology, to teach in secondary schools’ (Ofsted, 2006, p. 3).

The first of these recommendations arguably demonstrated a lack of understanding of food technology and its relationship to developing skills in cooking. The government’s response to the concerns raised was to create an ‘entitlement to cook’ for all pupils in secondary schools by 2011 (STEM learning, 2015).

This ‘entitlement’ emerged as the ‘Licence to Cook’ programme introduced in 2007 (STEM learning, 2015). This DfE-funded programme was led by a consortium group comprised of the British Nutrition Foundation, The Design and Technology Association and the Specialist Schools and Academies Trust. The programme was released with online resources and recipes with the intention that all pupils would have 16 h of cooking supported by an additional 8 h learning about hygiene and safety, diet and nutrition and wise food shopping. The lack of specialist teachers in many schools led to the course being delivered by school catering staff and other school personnel with an interest in cooking. This skills-based approach may have given some pupils the opportunity to cook who had not done before, but it did nothing to further the relationship between life skills and an academic study of food. At the time Rutland (2008) asked if the skill-focused ‘Licence to Cook’ programme was the ‘death knell’ of food technology?

To our knowledge, the shortfall of specialist teachers was never precisely identified but in 2009 funding was made available by the Teacher Development Agency (TDA) for the training and accreditation of specialist Higher Level Teaching Assistants to support the teaching of food technology in secondary schools (TDA, 2009). In addition, from 2007 initial teacher training providers could apply to run fully funded subject knowledge enhancement (SKE) courses to support the recruitment of trainee teachers providing the opportunity for teacher training applicants to enhance their subject knowledge before embarking on a teacher training course (Gibson et al., 2013).

In 2010 the change of government led to a new education bill, a revised National Curriculum and significant budget cuts. These cuts threatened the progress that had been made through the work of the School Food Trust (which later became the Children’s Food Trust) (BBC News, 2017). In April 2011 the government abolished the protection of subsidies for school meals. More than 3000 breakfast clubs closed in 2011. The rapid expansion of academies and free schools led to a Local Government Association warning that more than a million children at academies and free schools could be eating unhealthy food because the schools were exempt from the food standards which applied to other state schools. The DfE also announced that the Children’s Food Trust would receive no further government funding and future reviews of school food would be put out to tender.

Henry Dimbleby and John Vincent were commissioned to complete such a review, The School Food Plan (Dimbley and Vincent, 2013). The report made recommendations that extended beyond the provision of food in schools to putting 'cooking in the curriculum' (p.35). In its opening summary, it stated 'What you have in your hands (or on your screen) is not a traditional "report", or a set of recommendations to the government. It is a plan. It contains a series of actions, each of which is the responsibility of a named person or organisation. These are the things that need to happen to transform what children eat at school, and how they learn about food' (Dimbleby and Vincent, 2013, p. 8). Despite its laudable ambitions, funding for the plan ended in March 2016 and there was never an official formal evaluation of the project's success or otherwise (Scott, 2016).

The Obesity Issue

Concerns about childhood obesity and children's eating habits, spurred originally by Jamie Oliver, were reinforced by the School Food Plan and resulted in an arguably political focus on school food in recent years. High-profile commentators, such as Mary Berry (Nikkah, 2012) and Prue Leith (Marsh, 2018), have become involved in the debates on food in schools and these have led to political interventions that have included influencing the curriculum (the statutory requirement to teach cooking and nutrition within the D&T curriculum in Key Stages 1–3—11–14 years) and legislation (2014) that defines School Food Standards that apply to the provision of food in all maintained schools (DfE, 2019b).

In a review of the current position Owen Jackson and Rutland (2017, p. 63) argue that these political influences have been detrimental to the value of teaching about food and its potential for contributing to pupils' overall education as well as in defining what and where it can be taught in schools. There is no disputing that children need to learn about nutrition and making good food choices, and this is often heralded as a justification for including food preparation and nutrition within the school curriculum but an appraisal of the political interventions over recent years arguably does not present a coherent message as to how this might be realised. The result of these interventions also raises the concern about the recruitment and retention of food teachers in the English school system.

The politics of food education at the end of the first decade of the century had a direct impact on the new National Curriculum document in 2013 (DfE, 2013) and on the new General Certificate of Education (GCSE) specifications for pupil's aged 16 years. The former influenced by the aforementioned government-commissioned 'School Food Plan' included 'cooking and nutrition', with D&T noting 'pupils should be taught to cook and apply the principles of nutrition and healthy eating' (DfE, 2013, p. 3). As part of the curriculum reforms, there was a move towards linear examinations, and the course content for a single GCSE in Food Preparation and Nutrition was written to replace several coursework-heavy GCSE specifications (Design and Technology: Food Technology, Home Economics (Food and Nutrition), and Catering).

Where Do, and Will, Food Teachers Come From?

To become a qualified teacher in England, trainee teachers complete a programme of initial teacher training (ITT) that leads to qualified teacher status. There are a number of routes into teaching. These include an undergraduate route that is normally 3 or 4 years of 'on the job' training providing subject knowledge development and school experience, and postgraduate routes that are normally 1 year full time. Postgraduate routes can be undertaken through a Higher Education Institute (HEI) or a school-led route. School-led routes include school-centred initial teacher training (SCITT), School Direct (of which there is a salaried route and fee-paying route) or the Teach First Leadership Development programme.

The Department for Education (DfE) uses the Teacher Supply Model (TSM) to estimate the number of postgraduate trainees required in England in each subject and phase (primary and secondary) for each academic year (DfE, 2018). This model estimates the number of teachers needed to enter the profession accounting for a range of factors, including projections of pupil populations, the effect of new policies and estimates of teacher flow. Table 10.1 shows that each year the projected number and actual number of entrants has been below the forecasted need.

Since the 2016–2017 academic year, changes have been made to the process of allocating training places to ITT providers, involving the removal of formerly imposed controls on recruitment in D&T (Parliament: House of Commons, 2018). As Table 10.2 illustrates, the reality is sobering with only 33% of the target recruited in 2017/18. These figures are for all material areas as no distinction is made for food teachers alone.

How providers label subjects causes problems when looking at recruitment data specifically for food. Table 10.2 showed the overall trend for recruitment in all material areas. Interrogation of 'food' specifically suggests a similar decline in applications over time as shown in Fig. 10.1.

Low application rates for initial teacher training in England means that schools find it increasingly challenging to fill vacancies. TeachVac, a free, independent

Table 10.1 2016–2018: total secondary postgraduate (all subjects)

Year	Recruitment	Target	Contribution to target
2016/17	15,460	17,688	87%
2017/18	14,995	18,726	80%

Source: https://www.ucas.com/data-and-analysis/ucas-teacher-training-statistical-releases

Table 10.2 2016–2018: design and technology postgraduate (all material areas)

Year	Recruitment	Target	Contribution to target
2016/17	415	1034	40%
2017/18	305	917	33%

Source: https://www.ucas.com/data-and-analysis/ucas-teacher-training-statistical-releases

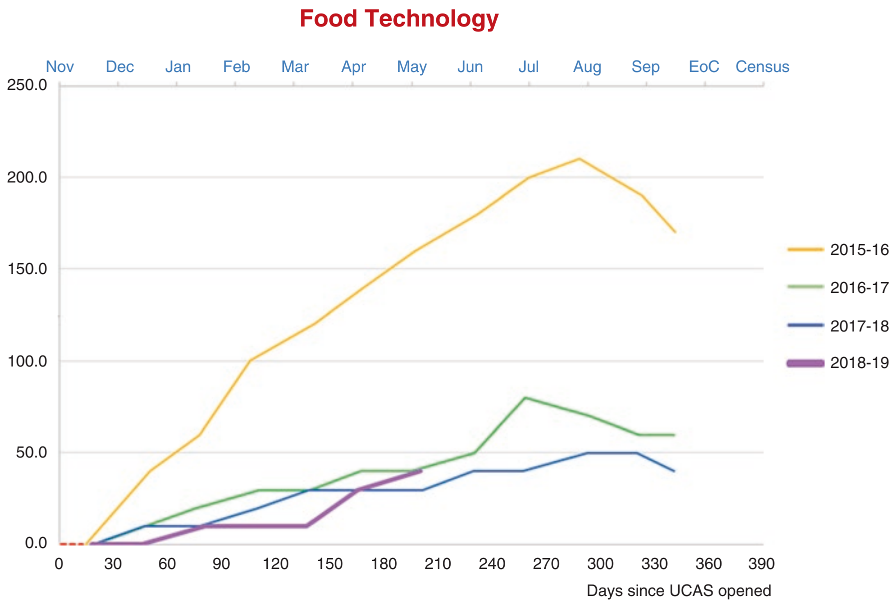

Fig. 10.1 Applications for food technology teacher training places in England from 2015 to May 2019. Source: https://www.ucas.com/data-and-analysis/ucas-teacher-training-statistical-releases

recruitment website, recorded just over 1600 advertisements for vacancies by schools seeking a D&T teacher during 2018 (Howson 2018). Some of these may be re-advertisements for posts that have not been filled. Even assuming a 25% re-advertisement rate, this would leave 1200 posts to be filled. Assuming 50% are filled by new entrants to the profession, a figure close to that used by the DfE in the past, this would require 600 new entrants from training, yet only 305 were recruited with possibly less than 50 having expertise in food according to UCAS data (Fig. 10.1). This is the number likely to be available to all schools, state-funded and independent, that want a D&T (not food specific) teacher with Qualified Teacher Status (QTS). Furthermore, we have to assume that some of these may not actually enter the profession, may defer their start, or wish to teach part time. The picture is worrying (Howson, 2018).

As an incentive to boost recruitment, eligible non-salaried trainee teachers on postgraduate programmes may qualify for a training bursary, a government incentive payment designed to attract highly qualified trainees in shortage areas. One may assume from the figures quoted above that trainee food teachers would be eligible for this funding but the reality has been quite different. Whilst subjects such as mathematics, science, modern languages and geography may qualify for up to £25,000, D&T, including food, has until recent times not qualified. In the most recent incarnation of the scheme, all eligible graduates have a £12,000 bursary but this appears to have had little impact on recruitment (Department for Education (DfE), 2019a, 2019b).

It has been contended that the reforms in ITT and education policy detailed earlier have contributed to this decline. Furthermore, the systems for recruiting teachers have had an impact on the recruitment of food teachers. The expansion of school-led ITT routes have caused some established university-centred provision withdrawing from training D&T teachers as low numbers make courses nonviable. In 2018/2019 there were 157 providers listed on the Department for Education ‘Get into Teaching’ website offering design and technology teacher training courses. Of these only 17 school-based courses and 15 university courses listed food as an area of focus.

The introduction of the English Baccalaureate (EBacc) has also had a significant impact on the status and viability of food in some schools. The EBacc was a controversial metric introduced in 2011 that is used to grade schools based on results in a series of core subjects. It was established as part of, the then education secretary, Michael Gove’s widely criticised reforms to the National Curriculum. His intention was to develop a more academic curriculum with the EBacc being a measure of pupils’ performance in traditional end-of-year examinations in English, mathematics, science, history, geography and languages. As this became an ‘accountable measure’, most schools adapted their curriculum for pupils at Key Stage 4 (14–16 years). The impact of this has been that pupils do not have as much opportunity to study the subjects that are not on this list, namely D&T, and the creative subjects (art, drama and music) so resulting in a hierarchy of importance being established. Despite a more recent accountability measure that reports pupils’ attainment in eight subjects (Progress 8), the English Baccalaureate measure has been retained with significant consequences.

A 2016 report published by Kings College for the National Union of Teachers found that teachers had serious concerns that the EBacc was dramatically narrowing the curriculum, and that the excessive pressure of examinations was taking its toll on young people’s well-being and mental health. Furthermore, teachers of creative, vocational and technology subjects reported experiencing increased job insecurity as colleagues face redundancy (Neumann et al., 2016).

This narrowing of the curriculum can also be demonstrated by the decline in examination entries in the subject. Entries for GCSE Design and Technology in England fell by nearly a third (32%) between 2012 and 2017. The new food GCSE is no longer included as a D&T subject but statistics for 2018 entries demonstrate that while entries for EBacc subjects rose by just over 5%, entries for food (including Hospitality and Catering and GCSE Food Preparation and Nutrition) declined by 21% (13,115 entries) (Office of Qualifications and Examinations Regulation (Ofqual), 2018).

While the decline in entries may be partially explained by the impact of the EBacc, it is likely that there are other influences including the lack of a clear progression pathway. The decision by the DfE to discontinue both the Design and Technology, Food, and Home Economics Advanced levels (for pupils aged 16–18 years) from 2018 is implicated here. This decision has implications for both industry and the future supply of well-qualified teachers. Buttriss (2017) indicates that the official reasons given for the decision focused on the lack of progression from Advanced

Level courses (pupils aged 16–18 years) to university warning that the effect of removal of these Advanced Level courses has implications for the teaching of food-based subjects in the school curriculum. Furthermore Owen-Jackson and Rutland (2017) suggest that the new GCSE Food Preparation and Nutrition does not prepare pupils for work in the food industry, other than catering.

We, as school governors, believe that there are also economic factors influencing the decline in uptake for a food-related GCSE courses. These are challenges that face families and schools. In many schools, pupils are required to provide their own ingredients for practical work with provision only being made for those pupils identified as being eligible for free school meals and so entitled to additional funding. The new GCSE Food Preparation and Nutrition requires pupils to develop technical skills and to work with a range of ingredients and the assessment process includes a formal 'practical examination'. For families with several children in school this can amount to a financial burden when other subjects are fully funded. For schools facing significant cuts, the cost of maintaining specialist rooms and employing technicians to support the subject can be brought into question, and anecdotally teachers are suggesting that technicians are not being replaced when they leave and that some schools are considering whether they should offer the subject beyond what is compulsory for the National Curriculum. This means that some pupils are denied the opportunnity of studying food beyonnd the age of 14 years.

The decline in the significance of food as an academic subject in England, evidenced by the decline in GCSE entries and exacerbated by the demise of an Advanced Level qualification, the EBacc and the economic climate, is likely to deter potential teachers from incurring the costs of training to teach a subject that has been marginalised. Whereas, in Scotland and Northern Ireland where there are still Advanced Higher and A Level qualifications available in Health and Food and Home Economics the subject is thriving and teaching remains a popular career option.

Conclusion

When looking at the evolution of food as a subject, it has evolved from domestic science, through home economics, to food technology with a more industrial focus, back into food preparation and nutrition. This could be construed as food education teaching coming full circle. There is, however, no circle for the evolution of food teachers. For the subject to have the status it should command, to meet the requirements of both the food industry and education, we concur with Owen-Jackson and Rutland (2017) that the redevelopment of an academic Advanced Level course is critical. We have anecdotal evidence that in schools where there are qualified teachers with expert knowledge, food education in various formats is thriving at the GCSE level. These teachers are currently denied the opportunity to engage in working with older pupils in a more academic context, as the current level 3 Food and

Nutrition qualification offers little progression from the GCSE. A post 16 Advanced Level course that offers pathways into the food industry and other food-related careers, including teaching, is necessary to give the subject academic credibility and draw enthusiasts into teaching. Whilst science and mathematical A Levels can support degrees in food science and technology the progression pathway is often not clear. An Advanced Level food course should develop pupils' understanding of food as a material for product development, and link to practical food preparation plus scientific and technological understanding. It is only then that there is a clear pathway from school to university, and possibly teacher training. Without this where will future food teachers come from?

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Chapter 11
Changing the Professional Identity of Food Technology Teachers in New South Wales, Australia

Deborah Trevallion

Abstract If a pre-service technology teacher is to teach Food Technology (FT) within Technology Education (TE) using a holistic approach, then the advancement of their professional identity as a technology teacher will be reliant upon the grasping of essential Technology Education concepts. During the period that this research was undertaken, 2012–2017, TE underwent major curriculum changes and this succession of curriculum change generated high levels of tension and confusion (Seemann, J Technol Educ 14:11, 2003), resulting in a change in identity for secondary TE teachers (Harfield, *Liminality, transition, transformation and educational re-thinking*. Paper presented at the Proceedings of the 8th Biennial International Conference on Technology Education: Learning for Life, Sydney 1 (pp. 96–104), 2014; Williams, Int J Technol Des Educ 23:1–9, 2012) and a resistance to further TE curriculum changes (Howard and Mozejko, *Teaching and digital technologies: big issues and critical questions*. Cambridge University Press, Port Melbourne, 2015).

This study focuses on the professional identity changes required to support the modifications to the TE curriculum, particularly Food Technology, and identifies a way to promote professional identity transition. It demonstrates how the developing professional teacher identity is impacted within the Technology Foundation Course that is mandatory for all pre-service Technology Education students at The University of Newcastle, NSW, Australia, and identifies the factors causing the greatest change. The focal lens is on the coursework and how authentic activity, including the Technology Day, held at a local secondary school, leads to a solid understanding of Technology Education. It uses personal folios, online reflective journaling and interviews as a way to trace the professional identity change and the results are presented using the Logic Framework Model. This research makes an important contribution to the field of Food Technology by identifying the factors that promote professional identity change in pre-service TE students. The research findings inform higher Initial Technology e-Education ITE programmes, whose aim is to promote a transition of a pre-service student's professional identity.

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Introduction

This chapter investigates, and identifies the factors that shape the professional identity of pre-service Food Technology (FT) education students who are transitioning from secondary education to university in order to become secondary Technology Education (TE) teachers. Technology Education is now called Technologies by the Australian Curriculum, Assessment and Reporting Authority [ACARA] (2016). In their official documentation and on their website the NSW Educational Standards Authority (NESA) have used Technologies as an umbrella to encompass the syllabuses of Computing Technology, Design and Technology, Engineering Studies, Food Technology, Industrial Technology and Textiles Technology.

Curriculum change is a constant in the Technologies and with a succession of curriculum change teacher's experience high stress levels and turmoil (Seeman, 2003), resulting in resistance to further curriculum change (Howard & Mozejko, 2015) and a change in teachers identity (Harfield, 2014; Williams, 2012). As such, the challenges associated with professional identity development must be addressed to enable the effective transition of a pre-service student to a Food Technology teacher.

This chapter focuses on the professional identity changes required to support the modifications to the NSW FT curriculum and seeks to identify a way to promote professional identity transition. This chapter makes an important contribution to the field of teaching Food Technology in secondary schooling by identifying the factors that promote professional identity change in pre-service FT students. The findings will inform higher education TE programmes, whose aim is to promote a transition of a pre-service student's professional identity.

Overview

The Technology Education (TE) curriculum in Australia has undergone change over the past 40 years, and with the national curriculum, there is more to come. These changes and a lack of understanding about what TE entails have resulted in the fragmentation of groups of TE teachers (Harfield, 2014; Seemann, 2003; Williams, 2012). Many pre-service TE students enter the Initial Teacher Education (ITE) programme believing that they will teach their professional skills using a didactic, lockstep, master-and-apprentice approach. The impact of the current and future curriculum, based on a contemporary, design-thinking, project-based learning approach, leaves them in conflict, wondering exactly what and how they will teach the critical thinking required in FT. The reconciliation of these internal tensions and conflicts is required to enable the effective transition of a pre-service TE student to a TE teacher.

In 1991, the NSW TE curriculum moved from a skill-based, 'lockstep' curriculum to a technology curriculum focusing on design and critical thinking, yet, almost three decades later, many teachers are still resisting change (Howard & Mozejko, 2015; Turner & Seemann, 2004; Walmsley, 2008). On the other hand, a few teachers are implementing contemporary changes, such as fully utilising technology in the classroom (Leonard, Fitzgerald, & Bacon, 2016), integrating blended learning situations (Alammary, Sheard, & Carbone, 2014), using flipped classrooms (Howitt & Pegrum, 2015), integrating e-learning (Weng, Tsai, & Weng, 2015) or considering the vertical integration of subjects using a science, technology, engineering and mathematics (STEM) approach (Boy, 2013, Doe, 2016; McAuliffe, 2016).

This resistance to change has resulted in a fragmented schema of TE (Williams, 2012), whereby pre-service TE students and new graduates find it difficult to clearly define what TE entails, to locate their situational professional identity (Hamilton & Pinnegar, 2015), and implement the expected curriculum changes (O'Connor & Scanlon, 2005). If pre-service FT educators continue to resist changes and focus of various Technologies curriculum, there is a risk that they might not comply with the Australian Institute for Teaching & School Leadership AITSL (2010) standards. There is a need, therefore, to investigate how the transitioning of professional identity may be supported in order to promote change imperatives in their classrooms.

Technology Education and Food Technology Curriculum Change, Tensions and Resistance

Technology Education was traditionally founded in skill-based learning using lock step progression. Traditionally the females studied 'cooking' to prepare them for married life and the boys studied woodwork. It was heavily influenced by a 1987 report entitled 'What Employers Want' which aimed to identify what business and industry needed and fulfil these needs with students educated and ready to move into work. This led to The Carrick Review in 1989 where the goal was to reduce gender bias and promote inclusive education using technology and design processes to develop practical skills and nurture a capacity for problem solving.

The mandatory, 1991, NSW Design and Technology Syllabus Years 7–10, considered an innovation-based syllabus that would build capacities to help Australia's future and quality of life (NSW Board of Studies, 1991). The syllabus moved away from the teacher-directed, manual training approach to that of a holistic learning style with the teacher in a creative facilitator role. The teacher view placed a high priority on developing skills first before students could attempt design projects, which were largely open ended (Turner, 2012). The syllabus supported a constructivist approach and many teachers were ill-prepared to teach this new pedagogy (McDonald & Gibson, 1995). The 2005 Technology (Mandatory) syllabus intentionally emphasised an object skills theme. The situation opened a serious disparity between fundamental needs to engender design and innovation skills for the future (Turner, 2012).

The implementation of The Technologies, a design-based holistic technology curriculum has forced Food Technology teachers to re-examine their professional identity. These curricular changes have resulted in confusion for Technology teachers (MacGregor, 2013) and a fragmentation of the teaching of Technology Education. The main barriers to the implementation of curriculum change are a lack of agreement of, and understanding about, what Technology Education encompassed, and a clear description of Technology Education schema (Forret, Edwards, Lockley, & Nguyen, 2013; Williams, 2009). An understanding of the nature of Technology heavily influences perceptions of Food Technology Education (FTE) and consequently shapes teaching practice (Forret et al., 2013).

Although the current continuum from stage 5 to stage 6 appears to provide a sound lead-in on paper, there is very little correlation to food science, innovation or environmental aspects. While nutrition may encourage students to take Food Technology in the senior years, students frequently choose Hospitality (Turner, 2012). The 2010 review for the NSW Stage 6 Syllabus for Food Technology resulted in a syllabus rewording. Higher-order thinking skills involving food science, innovation and holistic technological practice were removed and cooking recipes again replaced experimentation and testing of recipes.

This theme has played out over decades and the disconnection in teaching food science and technology as perceived by the profession of food technology has posed a significant problem in linking the subject to possible careers. This change in the syllabus has ensured debate between conservative curriculum values and the contemporary demands of a syllabus (Turner, 2012).

If the secondary students were to study both subjects, Food Technology with food science being taught from a strong perspective, and Hospitality, a syllabus which is gleaned from nationally accredited TAFE content, they would graduate with an excellent understanding of all food areas. The great chefs of the world do not use their amazing skills to emulate food production; they research, test, experiment and use their highly developed skills to create products that distinguish them from the norm. Some Australian teachers who suffer from a fragmented professional identity choose to focus on cooking skills in both courses, ensuring that their students do not see a difference and only elect to study one of these subjects, leaving them to flounder in food mediocrity as opposed to excelling in the creations of their chosen area of understanding. Food science and research was removed from Hospitality many years ago, allowing many students to wallow in mediocrity.

The implementation of The Technologies, and Food Technology as a design-based holistic technology curriculum, has forced teachers to re-examine their professional identity. These curricular changes have resulted in confusion for Food and Technology teachers (MacGregor, 2013) and a fragmentation of the teaching of Technology-based subjects. The main barriers to the implementation of curriculum change are a lack of agreement of, and understanding about, what Technology Education encompasses, and a clear description of Technology Education schema (Forret et al., 2013; Williams, 2009). An understanding of the nature of Technology heavily influences perceptions of Technology Education and consequently shapes teaching practice (Forret et al., 2013).

Promoting Professional Identity Transition

In the study The Changing Professional Identity of Food Technology Teachers (Trevallion, 2017), the participants enrolled in a TE Foundation course embedded within a Bachelor of Education—TE programme. This programme is only available to students with: a technology-related industry background, a minimum of 6 years' work experience, demonstrated success in ongoing learning and a range of personal attributes. Students enter the teaching programme on a competitive basis through an analysis of an evidence-based entry folio prepared by the applicant.

This research, based on the ontology of experience (Clandinin, 2007) used reflective narratives to capture the pre-service TE students' life stories. It is these stories that have provided insight into the pre-service TE students' professional identity. Identity is not viewed as static or fixed; instead, identity is framed using language formation where changes in professional identity are described by a socialising process that shapes identity (Woolfolk, 2007; Zare-ee & Ghasedi, 2014). This identity formation involves both identification and negotiability (Maynard, 2011). Identity is shaped by a lifetime of activity and interactions including past and present personal and professional life experiences (Day, Kington, Stobart, & Sammons, 2006; Furlong, 2013), prior university courses (Smith, 2007) and school and community-based encounters and collaborations (Rodríguez-Sabiote & Gallego-Arrufa, 2015; Woo, 2015).

Lev Vygotsky, in 1978, coined the term 'social constructivism', arguing that cognitive functions originate in, and are products of, social interactions. Learning is not just the assimilation of new knowledge; it is the process used to integrate learning into a knowledge community (Creswell, 2009; Lincoln & Guba, 2000). A key assumption in the constructivist classroom is that what the student currently believes, whether correct or incorrect, is important. In this study, all TE student beliefs and understandings were valued and built upon allowing open discussion of all perspectives. The researcher assumed that despite the pre-service TE students having the same learning experience, each TE student will base their learning on the understanding and meaning personal to them. Constructing meaning is an active and continuous process, and as a result the TE students understanding changed as they progressed through the coursework, completed activities and gained experiences that challenged and expanded their thinking.

Learning, involved some conceptual changes, for example in this case the student's conceptual understandings about TE moves from a traditional, hands-on, approach to TE that focusses on problem solving. In order to do this, it is necessary to acknowledge that when a student constructs a new meaning, they may not believe it but may give it provisional acceptance or even rejection. As constructing meaning is continuous, understandings evolve over time as the students undertake the responsibility to learn more about imposed concepts.

The pre-service TE students' transitioning of professional identity evolves through social constructivism, such as, social group membership (Hooley, 2007). Here the pre-service TE students share a common goal of becoming a TE teacher and share characteristics such as dignity, pride, respect, shared values and beliefs. As they work together to achieve their goal, their professional identity will be impacted upon through social constructivism. This research, based on the ontology of experience (Clandinin, 2007) and the ethnology of cultural experience, uses reflective narratives to capture the pre-service TE students' life stories. The learner's environment transmits the cultural tools, which include language, cultural history, social context and electronic forms of information access. It is these 'stories' that provide insight into the pre-service TE students' professional identity.

Framing Identity Through the Foundation Course

The study examined how pre-service TE students' professional identity adapts during the TE Foundation course in the first semester at university. The first semester at university is of prime importance, as this is when the greatest professional identity change occurs (Atkinson, 2012). The study explored how aspects of the course context shaped the professional identity of the pre-service TE students and how the TE Foundation coursework is underpinned by research in TE. The goal was to create a course that would clarify issues, reduce tensions and assist in the transitioning of the professional identity of pre-service TE students. The intervention coursework includes sharing life histories and builds trust and rapport to unify the students so that these connections encourage identity evolution. The specific TE Foundation coursework strategies contribute to the pre-service students' professional identity transition from trade workers to pre-service technology educators. An overview of the TE Foundation course is provided in Table 11.1.

Table 11.1 describes, and contextualises, the course content, strategies and experiences that are included in the TE Foundation course. The listed course inclusions provide information that, along with the time series analysis (as discussed later in this chapter), make it possible to identify which factors impacted on the pre-service TE students' professional identity. Through the reflections documented in the electronic journals, this study scrutinises the factors impacting professional identity and how it empowers pre-service TE students to move toward the teacher that they want to become.

Methodology

The multiple case studies used qualitative research to explore changing behaviours, perspectives, feelings and experiences of pre-service Technology Education students, in order to identify the factors that have affected their professional identity. Case study research assumes that examining the context and other complex conditions related to a case are integral to understanding a case (Yin & Davis, 2007). The relevant case study data comes from multiple sources of evidence, including entry folios, concept maps, reflective journals and semi-structured interviews that are used to triangulate results.

Table 11.1 Technology education foundation course content

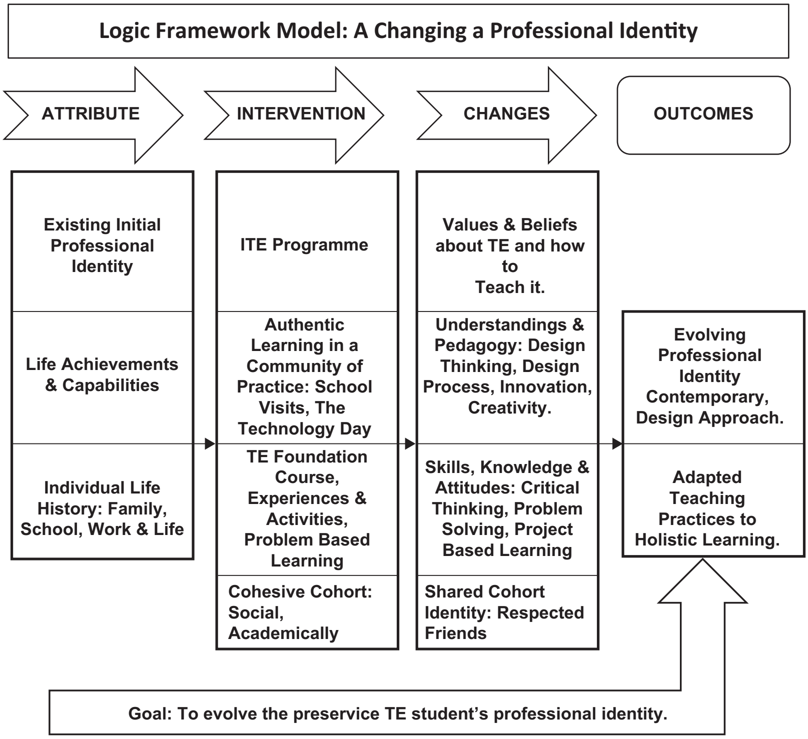
Week	Weekly activity
1	*What is Technology Education?* • Rapport and team building—link existing skills and current and future identities • Recognition of identities/shift in professional identity (Kennedy & King, 2008) • Development of entry concept map (Von Glasersfeld, 1991)
2	*All About Design!* • Building a unified cohort that helps participants to come together • Develop professional identity
3[a]	*Design and Technology—A Contradiction of Terms* • Secondary school visits, observing traditional and holistic approaches • Discourse on school community, classroom teacher, lesson and students • Authentic experiences, professional identity (Flores & Day, 2006) • Authentic images of self in the position of teacher (Beauchamp & Thomas, 2009)
4	*Critical Thinking for All* • TE learning imperatives, especially problem solving and critical thinking • Creation of classroom resources that support the learning imperatives • Journal reflections about school visits, critical thinking and TE • Professional identity—synthesis, integration and action (Sachs, 2001)
5[a]	*Design Thinking* • Interactive visit to a special needs school • Design brief: Promoting literacy in students with low reading motivation
6[a]	*Problem-Based Learning and Authentic Activity* • Implement solutions. Authentic activity promotes critical thinking, (Loepp, 2004) • Connecting academic learning with school experiences promotes deep understandings, which influence the developing professional identity (Zuga, 2000)
7 & 8	*Technology Education Curriculum* • NSW Technology Mandatory Syllabus; activities and lesson planning for The Technology Day. Students write a design brief and prepare lessons and resources • The lessons must be cost effective and will be used for The Technology Day
9	*Creativity* • Peers teach a 20-min segment of a lesson with subsequent feedback suggesting how to support teaching (Jones, 2002)
10[a]	*The Technology Day* • Teach and observe peers teaching TE using contemporary practice • Lessons taught in pairs; one teaches, the other writes an observation • Unified schema of TE resulting in improved classroom practice (Williams, 2012) • Reflective journaling promotes understanding of social identity complexity and, when combined with interactive contexts, they evolve professional identity (Monrouxe, 2009)
11	*Sustainable Design* • Adapting lessons to ensure a sustainability lesson focus
12	*Issues in the Classroom* • Discussion: Issues about TE to ease identity tensions • Shared reflections provide pedagogical space from the authentic learning activities. This space is necessary to synergise evolving identities (Atkinson, 2009), to encourage reflection and avoid projective identification with stereotypes (Mitchell, Cohen, Youakim, & Balaicuis, 2009)
Exam Week	*Case Study Participant Interviews*

[a]Refers to authentic experiences

Case studies of six Food Technology pre-service teachers participating in the foundation Technology Education course were analysed. The data analysis techniques included demographic and interpretive analysis, relational scoring, time series analysis and evaluation using the Logic Framework Model (Wyatt Knowlton & Phillips, 2013) in Table 11.2. For each participant, a Logic Framework Model was used to present the specific pre-service TE student's findings, it provided a technique for scrutinizing and undertaking an evaluation of the change in a cause-and-effect process where the participant's identity was analysed. Interventions affected their identity that resulted in initial outcomes followed by ultimate outcomes. The findings demonstrate that this model can be applied to all Technology education students.

The data collected provided extensive evidence to respond to the research questions. This study examined the professional identity transition of pre-service TE

Table 11.2 Logic framework: changing professional identity (Trevallion, 2018)



Attributes: The attributes refer to the characteristics of the initial professional identity belonging to the participant informed by research question one.	**Intervention:** The intervention is the set of activities that the participant experiences that cause a change in their identity informed by research question four.
Changes: The changes occur because of the interventions. They are characterised by changes in identity, beliefs, attitudes, thinking and behaviours informed by research question two.	**Outcomes:** The ultimate outcomes are the long-term changes that occur after the changes from the intervention informed by research question three.

teachers, including 6 pre-service Food Technology teachers during a TE foundation course. The TE foundation course is mandatory for all pre-service TE students in their first semester at university. Through this examination of professional identity transition using a case study approach, the research sought to identify factors that promoted professional identity transition. To achieve this aim, the research questions guiding the Food Technology component of this study were:

1. What were the pre-service Food Technology students' professional identities at the commencement of the course?
2. How do pre-service Food Technology students' professional identities change during the semester-long foundation course?
3. What were the pre-service Food Technology students' professional identities at the conclusion of the course?
4. Which aspects of the Technology Education Foundation course impact on the professional identities of pre-service Food Technology students?

Supporting the transition of a pre-service FTE student's professional identity might reduce resistance to the implementation of new curriculum changes. These pre-service FTE students will play an essential role in FTE, that is currently fragmented by the internal conflict and tensions that arise when one's value system is disrupted by major change (Sharplin, Stahl, & Kehrwald, 2016). Teachers who can reconcile identity tensions when integrating a changing curriculum may establish stability and common purpose within the Food Technology teaching area.

The link between the research questions, the data sources and the data analysis are in Table 11.3. This table lists five data analysis strategies—demographic data, pattern matching, interpretive analysis, relational scoring and time series analysis, beside links to the data sources associated with each strategy and the use of the Logic Framework Model.

Results

The findings from this study indicate that professional identity is reformed by the interconnection and the layering of life-influencing factors, such as life histories, university study, activities and interactions within the cohort, working together within communities of practice and school contexts. Developing pre-service Food Technology Education (FTE) students' professional identity is a complex, challenging, relational and multifaceted process. Each of the study's participants successfully combined the influences from their past, their present Technology Education Foundation coursework, the initial Food Technology Education programme and authentic activities within school contexts to develop a powerful social psychology to inform their evolving professional identity.

The Logic Framework Model demonstrates the changing professional identity of each of the Food case study participants. The data for each of the participants was different. The attributes showed that their initial professional identity could be

Table 11.3 Linking data to analysis to the logic framework model

Research questions	Data source	Type of analysis	Cross comparison Logic framework model
RQ1. Initial professional identity	• Student entry portfolio • Interview • Initial concept map	• Demographic data • Pattern matching • Interpretive analysis • Relational scoring	ATTRIBUTES Characteristics of initial professional identity
RQ4. Factors affecting the professional identity	• Online journaling • Interview • Exit concept mapping	• Pattern matching • Time series analysis • Interpretive analysis • Relational scoring	INTERVENTION A list of the activities and resources that influenced the changing professional identity
RQ2. Changes in the professional identity	• Online reflective journaling • Interview • Observation	• Pattern matching • Time series analysis • Interpretive analysis • Interpretive analysis	CHANGES The reactions, assertions and initial changes after the interventions and the interactions
RQ3. Final professional identity	• Online journaling • Interview • Observation	• Pattern matching • Time series analysis • Interpretive analysis • Interpretive analysis	OUTCOMES The professional identity changes at the conclusion of the TE Foundation course

viewed through their individual life histories and their intellectual and social capabilities. Whilst each participant was in the same Food TE programme, the same cohort of students and the same TE Foundation course had similar experiences but different factors within these impacted on their initial identity. This provided a specific list of interventions for each participant. The interventions influenced each participant's initial attributes and causal changes. The Food Technology participants each exhibited individual changes in values and beliefs, understandings and pedagogy, skills, knowledge and attitudes, and in their shared cohort identity. These changes resulted in an outcome for each participant showing an evolving professional identity and adapted teaching practices.

The Logic Framework Model demonstrates that pre-service Technology Education students enter the initial Technology Education programme with predetermined ideas and attributes demonstrating their future identity as a Technology Education teacher. The attributes shown in the initial identities were affected by interventions. These included aspects of the initial Food Technology Education programme, including the Technology Education Foundation course that provides intellectual, academic and social activities and experiences. These interventions resulted in changes in thinking, understandings and teaching that demonstrated an evolved professional identity embracing a contemporary approach to Technology Education. The demonstrated professional identity change moved from one that focused on a traditional, didactic, master-and-apprentice approach to a contemporary professional identity that focuses on a holistic approach to Food Technology Education where instead of students following the same recipes, they are presented with problems, such as those based on meal planning for specific dietary needs, which they research and solve by creating a range of food-based solutions. This contemporary identity aligns with the holistic approach promoted in the NSW Education Standards Authority's (NESA) 2019 Technology Mandatory and 2020 Stage 5 Food Technology and possibly the 2021 Stage 6 Food Technology Syllabus.

The four research questions guiding this study inform each section of the Logic Framework Model. Research Question 1 informs us of the participants' initial professional identity attributes. The intervention section of the Logic Framework Model is informed by the responses to Research Question 4, asking how the foundation course affected on the transition of the professional identity of pre-service Technology Education students. The changes in the Logic Framework Model are informed by research question two and the outcomes in the Logic Framework Model are informed by research question 3, which examines pre-service Technology Education students' professional identities at the conclusion of the course.

The cross-case comparison of the evidence from the six food case study participants revealed that the Logic Framework Model goal, to evolve the pre-service TE student's professional identity, has been achieved in every case. The data in the Logic Framework Model showed that each pre-service FTE student entered the FTE programme from a different background with different life experiences, as well as different values, beliefs and goals in life. Whilst different aspects of the intervention affected different students, there were common factors, including: the rapport built by the tutor; the close cohesive cohort; and the authentic experiences held in schools, including school observation visits, problem solving with students in schools and The Technology Day. These shared interventions resulted in changes in the participants' thinking, attitudes and values and their teaching and pedagogy, which in turn resulted in a changed identity.

Conclusion

In the world where change is a constant, TE curriculum reform is the norm. Many Food Technology Education teachers continue to resist syllabus changes and approaches (Williams, 2012). Here, pre-service Food Technology Education students and new graduates find it difficult to clearly define what Food Technology Education entails, to locate their situational professional identity (Hamilton & Pinnegar, 2015) and to implement the expected curriculum changes (O'Connor & Scanlon, 2005) and graduate standards that the Australian Institute for Teaching & School Leadership (AITSL, 2016) have produced. To prevent this from occurring, pre-service Food Technology Education teachers need to embrace change and reconcile internal conflicts in order to evolve their professional identity. The findings from this study provide a pathway for tertiary technology educators to begin this important process.

The study showed that in order to promote a change in preservice Food Technology teachers' professional identity and in order to improve their willingness to accept and promote curriculum change, university coursework must include the:

1. Support of student values and beliefs
2. Building mutual respect
3. Valuing life history and experiences
4. Development of a unified identity within the group
5. Mentoring in group situations
6. Participation in authentic experiences in a community of practice
7. No fear of retribution for opposing views
8. Ongoing, shared opportunities to reflect and evaluate

One can also view the pathway that pre-service Food Technology Education students follow when facing change that confronts their existing values and beliefs. The ontology and support of initial values and beliefs are essential as those who are facing conflicting values and ideals are experiencing identity challenges. These challenges occur because the preservice teacher may relate to the traditional FTE curriculum and hold onto it whilst resisting the different ideas promoted in the new curriculum. To help promote this professional identity change and an acceptance/ promotion of new curriculum ideas it has been found that the strategies that support the evolving of the pre service teachers' professional identity involve the pre service students in revised university coursework andragogy. The university coursework should include the valuing the Food Technology Education student's life history, building a rapport between students and tutors and between students that contribute to a unified identity theory. Within the university coursework, the pre-service Food Technology Education students need to experience mentoring, authentic activities in a community of practice. The students must be given opportunities to reflect and evaluate, without being told what to think. They each need to reflect upon and evaluate their learning as they contemplate their changing professional identity. This will result in Food Technology teachers who have developed skills that allow them to adapt to the various changes and challenges that they will experience throughout their teaching careers.

There will be changes to the Food Technology curriculum and syllabus, changes to pedagogies and student-centred teaching strategies, changes to the way they will use technological resources in their teaching and learning programs and in the classroom. They will be using e-technologies, m-technologies, virtual reality and iOS and Android applications in order to provide exciting lessons to stimulate their children. The content that they teach will include new emerging technologies, the problems that arise as the world population grows, as sustainable food becomes desirable and the production of healthy, sustainable, fast food becomes a must. This can be seen in the rise of vegan foods in restaurants and supermarkets. The pre-service Food Technology Education students must understand that they are responsible for teaching far more than cooking, they will need to use their skills to adapt their thinking, their professional identities as Food Technology Teachers to help their own student cope with change. They will need to change their professional identity to accept the change that occurs around them. By learning to take on board change rather than resist or fear it, these pre-service teachers will be better prepared to evolve their professional identity.

At the beginning of a foundation course, taking the time to get to know and understand each of the students is essential to their success. To find out about their background, life experiences and their existing values, the tutor must understand where the students are coming from, by listening closely to their personal contributions. The tutor must respond by providing positive reinforcement and an explanation of how the TE pre-service life history contributed to learning in the classroom. A rapport must exist between the students within the class and between the tutor and the students in order to build an environment that is conducive to a social constructivism situation. Students who share common characteristics, beliefs and values are encouraged to work together and share their existing and evolving values. When working together using cooperative and collaborative learning, the pre-service TE students will work together to help build a unified group identity where students respect each other and share developing opinions as they evolve throughout the semester.

In the planned coursework, mentoring evolves professional identity. The respect built with the tutor, and between students allows shared, considered and discussed ideas and challenges to evolve their professional identity. When planning the coursework, in order to evolve the professional identity, authentic activity needs to be included because authentic activity allows the students to relate learning to the classrooms in which they will be working. Authentic activity within these programs needs to be taught within a community of practice. This allows the pre-service Technology Education students to observe and evaluate new concepts, comparing them with traditional approaches that are used. This challenges their thinking as they link the outcomes of the observed activities to their thinking.

If identities are to evolve, the students need to use the concepts in a classroom without fear of retribution and with no marks allocated. The pre-service Technology Education students must be encouraged to risk using new processes and trial them before evaluating their teaching practices. To consider possible identity changes and changes in teaching activity, all pre-service Technology Education students must reflect upon their authentic learning activities in their community of practice. These reflections when shared with their respective mentors and group members evaluate and synthesise change to their professional identity.

In conclusion, when designing a foundation course that is aimed at introducing a new concept, or evolving the pre-service teacher identity, it is essential to share and respect student values and understandings. A strong professional rapport between students and tutor promotes these changes. Strategies that promote change involve students participating in observations and reflections on traditional and contemporary approaches used in communities of practices. They will observe, reflect, discuss and compare authentic learning opportunities in classrooms using traditional teaching techniques with classrooms where students have the opportunity to experiment and trial new concepts. They will evaluate the impact of with change paradigm being implemented before evaluating the success of the lesson. This reflective and evaluative thinking will evolve the pre-service teachers professional identity.

Food Technology teachers will each have a different life history, a different background and life experiences. Some will have backgrounds in cooking, catering, home science, home economics, and fast food businesses but this approach to teaching the Foundation course shows that everyone, no matter their background, is capable of making changes to their professional identity. The Food Curriculum covers a wide spectrum of food topics; it is far more than food technology, including industries, product development, cultural impacts, environmental and economic decisions and changes in products through new research and emerging technologies. These are global issues that affect Food Technology teachers around the world.

With important changes to Food Technology curriculums being assured, resistance is not going to move you forward. It is for this reason that I recommend this approach to the higher education Technology Education Foundation course. This way the pre-service Technology Education students will learn to evaluate change and evolve their professional identity and make appropriate and necessary adaptions.

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Chapter 12
Qualifications for Working in the Food Industry: Understanding All the Available Options for Students and Educators in Victoria, Australia

Bronwyn Graham

Abstract The Australian food industry is vast in its operations and opportunities. It is an industry that can cater to the career or employment needs of almost any person, with almost any skill level and capability. It offers opportunities for unskilled workers as well as for those highly skilled and highly educated. This industry is therefore uniquely placed for the opportunities it offers for the wide range of communities it services.

This chapter is devoted to the discussion of the career opportunities and the less direct methods of gaining the education and skills needed to access the many options for careers and employment for students in Victoria, Australia. It will cover aspects of the food industry and the roles it offers to potential employees, the role of the Food Studies/Food Technology teacher (previously known as Home Economics teacher) and this subject area in the context of "Where to next?" for students. This chapter explores the many pathways to qualifications and professions, the benefits and limitations of these pathways, as well as the methods of informing the key players involved, i.e. students and parents.

Keywords Skills · Career · Students · Food studies · Food technology Qualifications · Pathways

Introduction

For the purposes of this chapter's discussion, the following terminology will be used:

- Food Studies (formerly known as Food and Technology within Victoria), generally offered at years 11 and 12 as a subject in the Victorian Certificate of Education in Victorian schools

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- Food Technology, non-specific food subjects taught at levels below years 11 and 12 in Victorian schools
- Vocational Education and Training (VET) Provider includes Registered Training Organisations (RTOs) usually privately funded and Technical and Further Education Institutions (TAFE) government funded.

Food Studies/Food Technology Teachers in Victoria, Australia

The role of the food studies (and food technology) teacher is quite complex and involves delivering classes based up on curriculum content, from food safety and hygiene practices, menu planning and design process, to human nutrition and running practical classes. Notwithstanding this, time managing and budgeting for these classes is quite a challenge, but very rewarding. The need for teachers to remain up to date in their own skills and knowledge of the key content areas of the curriculum to be delivered includes the new Food Studies, study design introduced in 2017 (Victorian Curriculum Assessment Authority (VCAA), 2017). This in itself may prove to be a challenge for some teachers as its inclusion has increased requirements for the delivery in two key areas 'sustainability' and 'food science'. Added to all of the above, there is always the need for all teachers to inspire their students, for them to do well and be interested in their specific subject area.

The changes to the Food Studies course in 2017 make it a great option for those interested in pursuing work or further studies in the food industry, as it will expose students to a more in-depth look at what makes food do what it does when placed under certain conditions. This knowledge can be used to make new food products, select nutritionally sound food options and utilise sustainable food sources, for both now and into the future (VCAA, 2017). Subject areas about food, hold a very unique place within the education system as they may be the one subject area where students who do not do well in other areas, may excel. This may be due to the practical nature of the subject, or simply the reality of 'food' as the end result. Whatever the reason behind excelling in these classes, the knowledge that this is the case, may also serve as a catalyst to help students find their passion for their futures.

As quoted on the Home Economics website

> Our purpose is underpinned by our values and we believe: It is important for individuals to be empowered to make healthy choices and take responsibility for their own health and wellbeing. And "Home economics education facilitates the development of knowledge and skills to assist with the development of independent, resourceful consumer citizens capable of making informed decisions and establishing work/life balance. We believe this is achievable by engaging and educating young people in a variety of home economics contexts such as food; nutrition and health, consumerism and resource management; human development and family studies" (Home Economics Victoria (HEV), 2017).

The role of the Food Studies teacher, as for all teachers, is to be able to direct the students in their charge, to reach the highest level of their potential, not just in their current studies but also to gain the future career they are seeking. Having a strong knowledge of the food industry and good working relationships with the school career advisors are useful as starting points in exploring what options are available for students to pursue as potential career options for their futures.

Careers Within the Food Industry

Many people will have a number of different careers during their working life. The food industry, with its many options, is an industry that can offer options for role changes, and promotions, training and skill development, alongside further education, leading to new careers. Higher-level qualifications required for jobs at higher skill and knowledge levels may be pursued at any stage. Many school leavers may follow a linear career path and some will not and finding a career pathway that is 'one size fits all' is impossible, though, the skills and knowledge gained along different pathways can be invaluable in finding the 'right fit' of employer or business opportunity.

The food industry has roles for all levels of skill and education and qualifications, making it one of the most flexible and accessible industries in which to work. Students of Food Studies in the Victorian Certificate of Education (VCE or other food technology subjects prior to VCE), will gain a working knowledge of how to work with food safely and hygienically. This places them in a good position to gain employment in the food industry, having already gained some of the most important requirements to do so effectively (Victorian Curriculum and Assessment Authority (VCAA), 2017). A very basic online search for food industry careers using the online job search website of SEEK.com provides a snapshot of what is available in this industry, including everything from food packers and food engineers to food reporters and food stylists (SEEK.com, 2018). A more detailed search reveals the 10 'Cool Jobs' in the Food Industry (Doyle, 2018), listed as a diverse range of options such as craft brewer, food lawyer, mycologist (studies mushrooms) and molecular gastronomist, just to name a few.

The food industry is vast in its offerings and constantly changing over time. Roles that never existed as little as 5 years ago are now becoming commonplace, i.e. vegan chefs. These changes are often consumer or government driven or led, as a consequence of trends or needs. On the other hand, there are many people filling roles within the food industry, that they did not necessarily choose as a career option, but rather as a means to an end. For example, those undertaking post-secondary studies may find temporary employment at a food service level or in bar work, whilst they pursue their chosen professions. There are also numerous casual positions that are regularly available to secondary school students, providing them with their first taste of the workforce and of earning their own money. None of these options require post-secondary study prior to employment. However, there are also those who choose a career in the food industry, and they may need to have completed some post-secondary education prior to gaining employment. These may be at certificate levels for commercial cookery, bakery and patisserie, diploma and higher education levels, such as nutrition, food science or dietetics or an apprenticeship that provides in-service training.

The level of qualification required to work in the food industry is dependent upon the role that is being filled. Qualifications range from the lowest level of Certificate 1 in Food Processing, for those who may work as general labourers or machine operators in the industry, up to Doctorate level for those working in research or other high-level management and 'decision making' roles in the industry. Many courses available to study for qualifications, can be offered as a part of workplace training after. This is offered as a part of the employment agreement. This form of training is most commonly offered at Cert I-III level, or higher if the company has a need for higher level qualified personnel. Qualifications at degree-level and higher may be required prior to gaining employment for certain roles within the food industry, such as Quality Control Officers, Food Technologists, Laboratory staff, Food Product Developers, Sensory Analysts, etc. This is mostly governed by the potential employer, as there are currently no legislated qualification requirements for these types of roles. However, in order to successfully operate in such roles a person would need to have a certain level of skill and knowledge that demonstrates their ability to function at the required level of expertise in any of the above-mentioned roles.

The student seeking to gain a Higher Education qualification in Food Technology or similar, choosing to study Food Studies (VCAA, 2017) at VCE level (Victoria) is a way to introduce the concepts of food-industry-specific skills and knowledge. This course includes many key areas of study that offer students insights into the food industry. Some of the topics covered in this course include food science and technology, food safety and hygiene, food product development and the functionality of food ingredients.

In order to pursue a career path that requires a Bachelor (degree level) or higher-level qualification, a successful completion of the Victorian Certificate of Education (VCE) is required for school leavers in order to be offered a place in a higher education degree course at University. However, there is currently no prerequisite for students to have undertaken the Food Studies course during their VCE (VTAC, 2018).

Victorian Certificate of Education (VCE)

Within Victorian schools, the VCE is offered as the final years of study for a secondary school student after completing 13 years of formal studies in school. Students are generally between the ages of 16–18 years when they undertake this certificate. It is completed generally over 2 years, but some subjects may be started earlier, allowing for a 3-year completion of the certificate. It is an accredited, secondary certificate and it is the highest level attainable in education via the school system within Victoria. There are other options as well, for example the International Baccalaureate, which is available only through a limited number of schools and offers international recognition and equivalence to the VCE in most instances, especially in regards to higher education entry. The Victorian Certificate of Applied Learning (VCAL) is also an accredited secondary certificate offered in Victoria but this does not usually lead to direct higher education entry. This chapter will not cover the International Baccalaureate in any depth, as the VCE is the most widely available school certificate in Victoria, which provides higher education entry.

The VCE course is made up of subjects divided into 4 Units, all of which are of one semester in length, some of which must be studied in sequence. Students typically study Units 1 and 2 in their first year, and Units 3 and 4 in their second year of the VCE. You can study Unit 1 or Unit 2 of a subject as stand-alone units, however, you must enrol for Units 3 and 4 of a study in sequence. This sequence needs to be completed in the same year if a study score is to be calculated. Students usually study from 20 to 24 units (five or six subjects) in Years 11 and 12, the final 2 years of formal school studies as mentioned above. You can take longer than 2 years to finish the VCE if required, with some students starting the VCE in Year 10, and some study Units 3 and 4 in Year 11 (Victorian Curriculum and Assessment Authority (VCAA), 2018a, 2018b, 2018c).

To achieve a completion in VCE a student 'needs to successfully complete 16 units including: three units from the English group, two of which must be a Unit 3 and 4 sequence and at least three additional Unit 3 and 4 sequences' (Victorian Curriculum and Assessment Authority (VCAA), 2018a, 2018b, 2018c). VCE Food Studies underwent a major overhaul and a name change from Food and Technology to Food Studies, to better represent the content of the subject, resulting in a new study design introduced in 2017. The new study is designed to have a greater focus on food, where it comes from and how to produce it sustainably and how its different components act and react, thereby providing a greater insight into the related food science. It opened the door for students to gain an in-depth understanding of the many, and varied, aspects of food and how this correlates to options for their employment and studies beyond school.

Australian Tertiary Admission Rank (ATAR)

The ATAR is often the gold standard by which all results, all choices, all studies are measured by within a school, within a home and by students. The ATAR is the number that determines what higher education course may be offered to the successful VCE student but is only of value to those who desire to gain a higher education place and future qualifications at degree or higher levels.

> The ATAR is a rank, not a mark, it is a number between 0.00 and 99.95 indicating a student's position relative to all the students in their age group (i.e. all 16 to 20 year olds in NSW) (UAC, 2018). It is calculated by Victorian Tertiary Admissions Centre (VTAC) based on up to six VCE 'scaled' study scores. Study scores are scaled up or down by VTAC according to the performance of students in a study in a particular year—which means scores change each year, making ATARs difficult to predict (Deakin University, 2018).

Students are advised to undertake studies in areas that they like and are good at in order to achieve the best possible ATAR for their efforts. Students often mistakenly choose subjects that are scaled up as they believe this will increase their chances of a better ATAR. However, if the studies a student undertakes are not interesting or too difficult for them, then the risk is they will gain an overall lower ATAR regardless of any scaling that has occurred.

Benefits to Students' ATAR by Studying Food Studies

A number of schools offer Units 1 and 2 Food Studies at Year 10 level when students are generally between the ages of 15–16 years, then Units 3 and 4 at Year 11 level. This may be advantageous for the final VCE outcome for students undertaking their studies in this manner, especially as they often only take 1 subject at 3 and 4 level in Year 11, which means less subjects need to be studied in Year 12 to complete the VCE. Also if the student performs well in the subject it may help to boost their ATAR. Food studies may help students gain a higher ATAR particularly if this subject area is one that holds a strong interest for them. (Victorian Curriculum and Assessment Authority (VCAA), 2018a, 2018b, 2018c, 2020).

Options Within Schools

Linear progression for students from school with VCE completion into higher education and then professional life may be the ideal outcome after 13 years of formal school education, starting from the early age of 5–6 years right up to the ages of between 16 and 18 years. However there are many students who will not progress in this manner due to a myriad of reasons. Some students may choose a different pathway, which may include taking time off from formal studies to explore the world after VCE completion. Others may explore the world in the workforce by finding a job and then return to studies, or never return to studies at all. Others may not achieve what they set out to do during their final school years in VCE due to unforeseen circumstances in life, or not perform as they should, or would have like to have done, meaning they cannot directly enter into Higher Education courses straight after VCE. Some may not complete the VCE and choose a different route towards their desired qualification and subsequent career path, whilst others may not desire a post-school qualification at all. There are options to help students acheive their goals beyond gaining a desired VCE score or ATAR no matter what circumstances a student finds themselves in.

Vocational Education and Training (VET)

One option for students who need to find a different pathway to gaining the qualifications they need to pursue their dream career is within the Vocational Education and Training (VET) sector.

All Australian citizens are eligible to complete a Government-funded VET course (Nationally recognised Certificate level qualification) within their lifetime, provided they meet certain criteria as specified on the website, which includes eligibility rules (DET, 2018). It is important to realise that these eligibility rules are in no way affected by students in schools, who complete training under the VET in schools (VETis) programs (See VETis section below). Courses at certificate and diploma levels via VET can provide for the needs of these students and can lead directly into university courses (Higher Education courses), with many universities offering credits from VET towards their courses.

There are many advantages for students who choose to undertake studies in the VET sector, either by choice or as an alternative entry pathway to higher education options. One factor in the pathway via the VET sector, that can be quite attractive, is that there are usually no VET course entry requirements, except at diploma and above levels (VTAC, 2018). Also, if subject credits are offered by the higher education institutions upon entry to their course, this results in reduced fees for the course. Another advantage is that the type of training a student will gain via the VET sector is much more practical (hands on) than theoretical and may better suit the learning style of those students. Another advantage is that students who complete a VET course will have work-ready skills and be able to enter the workforce immediately.

The VET sector is often perceived as being the 'poor cousin' to the higher education sector, often due to the lower level of qualifications offered, but it may also be due to its history of development. Basically the VET sector was traditionally where tradesmen gained their qualifications to work in their trade, via the apprenticeships scheme, and in the past, trades were not viewed as highly desirable as academic-type qualifications. This is no longer the case, as the VET sector nowadays offers training in many areas from trades to business skills with qualifications higher than Bachelor Degrees in many different disciplines. So a student who was unable to enter a university course directly from VCE can study at VET and pursue higher-level qualifications through this pathway, even without a completed VCE. If they choose to access the VET sector and complete a course in their chosen discipline, such as food science or nutrition or a hospitality certificate course, students are then able to apply for credit points towards a degree course in the future. However, pathways from the VET sector to the higher education sector are not always clear or fully seamless in structure, unless a specific VET provider has been able to negotiate structured pathways with universities. If this is not in place prior to commencing a VET course, students may need to negotiate these pathways themselves and get the agreement from the higher education provider in writing before commencing their VET course.

VET in Schools (VETis)

The VET sector also operates within schools (Secondary schools providing different options for students. Whilst they are still in school, students who do not wish to undertake VCE may select to do the Victorian Certificate of Applied Learning (VCAL) instead, which incorporates the study of a VET subject to complete the certificate or study a VET subject as part of their VCE (VET in schools program (VETis)) or study a school-based apprenticeship. Each of these represents different approaches to finding a way forward for an independent future for students. Each of these is also a great step toward working in the food industry as food-related subject areas play a large part in these offered programs. Currently there is only one approved subject option that can offer a contribution to a study score (in VCE) and that may help with working in the food industry, hospitality, including 2 Certificates, is available and the relevant contributions are listed below:

- *SIT20316 Certificate II in Hospitality*: recognition of two or more units at Units 1 and 2 levels and a Units 3 and 4 sequence
- *SIT20416 Certificate II in Kitchen Operations*: recognition of two or more units at Units 1 and 2 level and a Units 3 and 4 sequence (Victorian Curriculum and Assessment Authority (VCAA), 2018a, 2018b, 2018c)

Another VETis option not directly related to a food subject is Laboratory Operations, which is also an approved study option and this may be of interest for students keen on a science-related career in the food industry. Students can also elect to study VETis without it contributing to a study score, an option useful to those not choosing higher education options.

> Students wishing to receive an ATAR contribution for the VET Hospitality program must undertake scored assessment for the purpose of achieving a study score. This study score can contribute directly to the ATAR either as one of the student's best four studies (subjects) (the primary four used to calculate their ATAR) or as a fifth or sixth study.
>
> **Note:** Where a student elects not to receive a study score for VCE VET Hospitality, no contribution to the ATAR will be available (Victorian Curriculum and Assessment Authority (VCAA), 2018a, 2018b, 2018c).

VETis enables students to gain a Nationally recognised certificate-level qualification prior to leaving school and this qualification does not in any way affect their eligibility for further VET study later (Skills Impact, 2018). VETis also includes School-Based Apprenticeship or Traineeship (SBAT), which are an apprenticeship or traineeship that incorporates at least 1 day per week (time-tabled) spent on the job or in training during the normal school week. These are available to students enrolled in a VCE or VCAL program (Victorian Curriculum and Assessment Authority (VCAA), 2018a, 2018b, 2018c). These allow the student to participate in a paid part-time employment arrangement and training, concluding a nationally recognized qualification of Certificate II-IV, as well as the completion of secondary school (Victorian State Government, 2018).

There are over 500 occupations Apprenticeship Support Australia (2020) that may offer this type of arrangement, and many of these options are available in the food industry. The level of certificate to be completed and the job itself will determine the length of time required for completion as a number of SBATs will not be completed until after secondary school completion.

Apprenticeships

This is an option undertaken by students who either finished secondary school (no certificate completed) or did not complete secondary school, and gained employment as an apprentice (This offers full time employment whilst training for a qualification and differs from an SBAT which is part-time whilst still attending school). This option is often offered within the food industry, particularly in food service-type roles such as cookery, bakery and also meat processing. Individual employers may require differing prerequisites for employment in such a role, but the training provided by a VET provider does not have any prerequisites, as an apprenticeship qualification is Certificate III level. This option is a good option for students who do not want to complete secondary school but would like to gain a qualification, or those who are seeking paid full-time employment, leading to a qualification whilst they work. The VET sector can be seen to be a very valuable option for students within training and education, especially for qualifications and roles offered within the food industry.

Accessing Information for Students and Teachers

The options presented above are a brief snapshot to showcase the different options available to a school-based student, to ensure those seeking information have a starting point from which to proceed. Teachers and career advisers within schools are often the first point of contact with regard to helping students find the right pathway for their future. Parents or guardians of students often play a role in decision making as well; however, the information that is passed on to all of these key players can be slow in its provision or not easily accessed or understood. There does not seem to be one place to find all information, or the information required, changes so quickly that it is difficult to keep up with the changes. Added to this, the education sectors within Victoria do not always work well together, further complicating the flow of correct information.

Government funding provision for the different education and training sectors adds to the confusion (The government provides funding to reduce course costs, making courses more accessible) as it is difficult to keep up with the information about the level of funding being offered for which courses. Career practitioners and subject teachers need to keep abreast of these factors in order to provide information and advice to students and their parents/guardians. It is also important that students find out as much information as possible to help themselves. Finding course coordinators at post-secondary education providers (Universities, TAFES etc.) is a good start to the process and can be invaluable in finding out what is required. The Victorian Government has also funded Skills and Job Centres based at several VET providers throughout Victoria, and the staff in these centres can also help students seeking advice about their careers (DET, 2018).

Changes within the food industry also require an understanding of how to cater for the needs of the industry when such changes occur. Those changes may be legislative; new food safety and hygiene requirements or food labelling requirements, such as Country of Origin labelling, or the changing needs of a changing consumer population, for example how and where consumers purchase their foods, which has significantly changed over the years. These changes, result in the changing needs of the workforce and the training or education of this workforce.

As demonstrated in this chapter, there are many options available in Victoria for students seeking to gain a qualification in order to pursue a career within the food industry and many roles they may fill. The role of the Food Studies teacher should encompass helping students to navigate their way to meeting the students' future needs, particularly if a student shows a desire to work with food. Ensuring students have access to the information to help them pursue their goals should also feature in schools' management, and providing the information to parents and guardians will also help ensure students find the right path toward an independent life for their future.

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Chapter 13
Continuing Professional Development for Secondary Food Technology Teachers in New South Wales (NSW), Australia

Carly Saunders

Abstract The case for continued professional development is a compelling one. This statement is prevalent because no matter how outstanding pre-service education is, the fact is that teaching is and always will be ever-changing. Despite the mandatory requirement for a bachelor's degree, the difference in teacher's knowledge and ability is vast. In order to assist our students to have a fair and equitable education, we need to address this and consider how things like high-quality resources, sharing ideas and pedagogical strategies can help to bridge the gap.

This chapter aims to examine the needs of teachers in preparing their Food Technology students for the future through qualitative research surveys of 241 NSW teachers and observational research of the 1066 attendees to our Teacher Professional Development courses.

Keywords Professional development · Food technology · Mandatory accreditation

Introduction

Valid, relevant and fulfilling professional development for teachers is essential if it is expected to impact and engage twenty-first-century learners in schools. However, not all teacher professional development is created equally. In examining the needs of our teachers, we have discovered that teachers are 'time poor' and this can impact the quality of the resources they create and thus the engagement of their students. The diversity of topics in our NSW Stage 4 (ages 12–14), Stage 5 (ages 15–16) and Stage 6 (ages 17–18) Food Technology syllabus can also impact teacher's ability to link student's acquired knowledge and their ability to apply it. With ever-changing content such as innovation in food design, food trends, food product development

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and emerging technologies in food, teachers can find it challenging to stay abreast of trends and remain current. Teacher professional learning standards must be implemented meticulously to ensure best practice is a priority and to support teachers in lifelong learning.

In 2017, the NSW Education Standards Authority (NESA) mandated that all teachers must accrue professional development hours to maintain teacher accreditation. NESA Registered Professional Development can only be delivered by Endorsed Providers who have completed a rigorous assessment and approval process. This assists in screening the copious amounts of teacher professional development available. The Happiness Mission® became an Endorsed Provider of NESA registered professional development (PD) in November 2016. However, the length of time and processes that must occur to wear the NESA Endorsed Provider badge were unexpected as the process is elaborate to ensure that NESA can assure each provider's integrity, responsibility and suitability for such a role.

The process began in March 2016 and the application checklist involved hours of planning, research and gathering articles and documents. Information included: procedures in place to assure the quality of presenters; presenter's qualifications; relevant background/experience; presentation screenshots; hand out samples; fundamental research and examples of feedback. Alongside this, Australian Business Number and policies and procedures to assure the quality of delivery and evaluation of courses were required. Marketing and advertising evidence were also supplied to ensure the advertising of professional development products and services were both appropriate and ethical.

Two provider sessions with NESA staff in Sydney were mandatory to attend. The sessions were designed to simplify the process and support NESA providers with any questions or concerns. We met other providers who were applying to teach all manner of different teacher professional development courses, from perfecting golf skills for Personal Development, Health and Physical Education (PDHPE) teachers to understanding the importance of sleep on wellbeing and resilience. It was interesting to see all the different reasons for people wanting to become a NESA provider, but one common theme was the willingness to want to help teachers.

The Process of Accreditation

NESA assisted us to provide appropriate content for the professional standards that The Happiness Mission® was approved for:

> Standard 2—Content and teaching strategies of the teaching area in the proficient focus area: 2.1.2 Apply knowledge of the content and teaching strategies of the teaching area to develop engaging teaching activities.

This specific focus area required much consultation with NESA because of the language 'content', 'teaching strategies' and 'engaging'. Each activity planned for the professional development days needed to encompass teaching strategies that were directly related to the syllabus outcomes and dot points, and they needed to be engaging in a contemporary manner. Resource samples were provided, and NESA would provide feedback and suggestions for improvement.

> Standard 6—Engage in professional learning: 6.2.2 Participate in learning to update knowledge and practice, targeted to professional needs and school and/or system priorities was simpler to plan for.

It was mandatory to produce evidence that the courses were updating teacher's knowledge in the Food Technology content area. Samples of the presentation and current research examples assisted NESA to see that the courses would demonstrate Standard 6 requirements.

The first course ran in Sydney in November 2016. It was called 'Teaching Higher School Certificate (HSC) Food Technology Successfully'. It sold out in a matter of days as teachers had expressed the complete lack of professional development opportunities that were content specific for Food Technology teachers. Through feedback forms, which are a compulsory element of any NESA registered course, it was discovered that teachers wanted more courses, and so 'Teaching Preliminary Food Technology' ran shortly after.

The following year, 2017, two more courses were launched: 'Year 9 Food Technology Fun' and 'Year 10 Food Technology Recharged'. These courses were based on the Stage 5 syllabus and included resources, teaching strategies and assessment tasks. NESA also sent employees to attend our courses to ensure our processes, procedures and policies were of exceptional quality. Our duty was to keep accurate, secure files which contained sign on attendance sheets, feedback forms and any email correspondence. It became apparent that the courses should be taken on the road, and we began running courses from Sydney, Newcastle, Wollongong, Coffs Harbour, Dubbo, Orange, Wagga, Tamworth and Ballina.

When NESA released the Technology Mandatory Draft Syllabus, which included a variety of significant changes in the Stage 4 syllabus it became apparent that resources to assist the successful implementation of the new syllabus were required. The new course 'Technology Mandatory, Agriculture and Food Technologies' took up the majority of the first 6 months of 2018. From there 'Technology Mandatory, Materials Technology, Textiles Focus' became a priority for the second half of 2018. Due to the number of courses accredited with NESA by then, The Happiness Mission® was awarded a scope for the two standards which meant other presenters could produce courses under our accreditation banner.

However, it was mandatory that we still provided quality content delivery and had policies and procedures in place to prove such quality. The Happiness Mission® now has five other presenters in the areas of 'Technology Mandatory, Engineering Systems', 'Cake Decorating Skills', 'Textiles and Design Drawing', 'Community and Family Studies' and 'Hospitality at Your Service'. It is our responsibility to upload all course plans, feedback forms, sign on sheets and event plans to NESA. NESA is very strict about the feedback. They independently survey the participants and withhold professional development points until the surveys are completed. There is a need to ensure that most of the feedback is excellent or NESA will remove the course from our scope.

Data Collection and Analysis

The value of the feedback is priceless. We learn so much about the needs and wants of our teachers in these forms and the comments and questions they ask at the courses. We have built a community around our teachers. They share resources, strategies and questions on our social media forum.

The survey was distributed via email to the Food Technology teachers who have attended our courses. When asked to complete the qualitative survey research for this chapter, 241 NSW teachers agreed and submitted responses. The data was analysed by reading all the responses and looking for similarities and trends. This assisted us to find themes and categories within the responses. The research did not require State Education Research Applications Process (SERAP) clearance because it is considered a survey opinion poll, but we requested that teachers ask their principals permission before submitting a response.

There were no criteria to choose; teachers simply responded with what professional development opportunities they would like. The responses were invaluable to see where the gaps in knowledge were for the 241 NSW teachers (N = 241) (Table 13.1).

Table 13.1 Saunders (2018) 'What professional development courses would prepare you for teaching future food technology students?'

A	Practical, hands-on, recipe testing, cooking on a budget, cooking to an hour time period	39
B	Stage 6, HSC compliance, teaching students to excel with exam responses	34
C	Innovative ideas, strategies, best practice pedagogy	30
D	Emerging technologies, future food, food science	29
E	Technology mandatory: agriculture and food technologies	28
F	Stage 5 (Years 9 and 10) food technology content specific	26
G	Technology, coding, robots for food manufacture, food app development, 3D food printing	25
H	Engaging students in twenty-first-century food technology education	23
I	Food manufacture, food product development, industry knowledge	22
J	Updated information, case studies, academic rigour refresh	20
K	Ready to go, fun, syllabus-driven resources	19
L	Networking, sharing with other teachers, resource making	17
M	Ideas for programs	16
N	Ideas for quality assessments and reporting/feedback	15
O	Nutrition, health and wellbeing	9
P	Food trends	9
Q	Molecular gastronomy	8
R	Food safari/excursions	6
S	ESL, differentiation, planning for learning disabilities	5

Analysis of Findings

In this section, the discussion will focus on the six most popular responses:

a. Practical, hands-on, recipe testing, cooking on a budget, cooking to an hour time period

This response brought to the forefront the changes in Food Technology education and how they have affected teachers and students. In many ways, Food Technology education is occurring differently than it has in the past, including time. Many teachers responded that they have had their period allocation reduced to 1-h, where they have had the luxury of double periods (usually around 75–80 min) in the past. A common issue raised within their courses is the need for recipes which can be altered to reduce cooking time.

Many schools have opted for shorter periods with the aim to keep students engaged and to keep behaviour corrections to a minimum, for example school timetables which previously only had four periods have increased the periods to five or six. As a result, student's lessons are broken and for Food Technology teachers this has impacted on the skill level of the practical recipe which can be attempted. Andersen, Humlum, and Nandrup (2016) claim it has proven to be a major challenge to determine how different educational resources, such as instruction time, affect student learning. However, through a large-scale randomised trial they have presented evidence that increasing instruction time in school increases student learning. It is interesting that despite this, the time in each period is reducing in many NSW schools.

In many of our course teachers ask for cheaper options, or ingredients that can be removed or replaced due to low budgets for teaching in low-socioeconomic schools where parents often do not have the capacity to pay fees. Many rural teachers also find it difficult to source produce what is not stocked in their local supermarket. Less common ingredients such as rice malt syrup or agave syrup (common sugar substitutes) cannot be purchased easily in country supermarkets. Likewise, it is not always accessible to source fresh fruit and vegetables. To ensure teachers are fully equipped to teach students in their current circumstances, it is imperative that they are given the opportunity to access professional development that suits the requirements of their school. This could be an external course that they attend or an in-service session within their school with other expert staff members, planning and organising the practical lessons to maximise student learning opportunities.

b. Stage 6 HSC compliance expecting teaching students to excel with examination responses

This response demonstrates the need for subject-specific, content-driven professional development. Food Technology student enrolments for Stage 6 have been steadily declining as demonstrated in Graph 1. This is a concerning trend and does not follow the patterns of the NSW HSC total candidature visible in Graph 2 (Fig. 13.1).

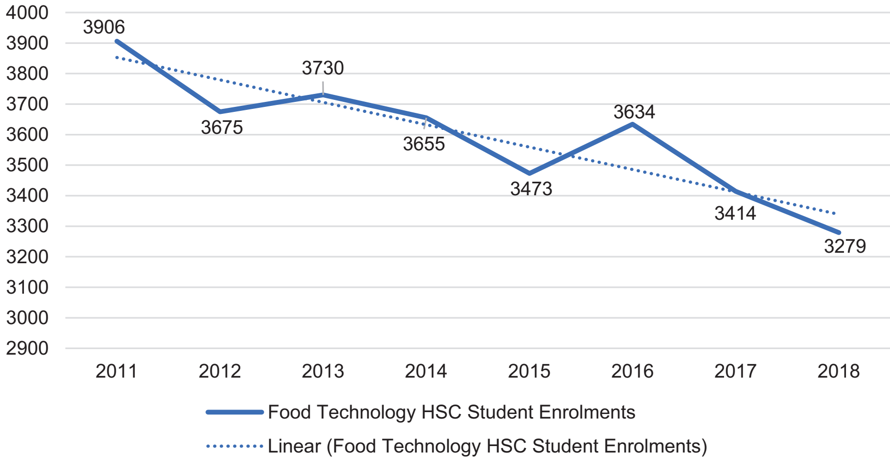

Fig. 13.1 Board of Studies Teaching and Educational Standards NSW (2018) NSW *Food Technology HSC Student Enrolments from 2011 to 2018*

HSC compliance is a reported source of angst for NSW teachers. High expectations, pressure from parents and executive staff and the responsibility for students' futures can mean that the staff feel overwhelmed year after year. Richardson, Watt, and Devos (2013) believe that teachers worn down by their work exhibit reduced work goals, lower responsibility for work outcomes, lower idealism, heightened emotional detachment, work alienation, and self-interest. The HSC compliance workload is likely to impact more on new teachers, as they may lack the experience and resources required to teach HSC Food Technology effectively. When teachers become burnt out, or worn out, their students' achievement outcomes are likely to suffer because they are more concerned with their personal survival.

The 'Teaching HSC Food Technology Successfully' course has been popular despite the declining HSC Food Technology student enrolments. The Happiness Mission® is an endorsed provider and so we receive Provider Course Evaluation reports from NESA. The anonymous comments provide feedback on what participant's value in the course. Participants value the opportunity to update knowledge targeting Stage 6 HSC Food Technology syllabus requirements, receive current teaching and assessment resources.

Avalos (2011) reports on the effects of professional development on student outcomes supporting the view that student outcomes generally improved as teachers learned to adapt teaching to individual student needs. The necessary nature of teacher professional development is supported by (Craig, Meijer, Broeckmans, & International Study Association on Teachers and Teaching, 2013), who state that teacher satisfaction increased in relation to professional development activities considered to be 'close to home', relevant to their needs and expectations and when they contributed to the improvement of curricular understanding and increased self-efficacy. Content knowledge is important, but the method of delivery is vital if participants are going to leave the experience motivated and willing to engage their students.

c. Innovative ideas, strategies, best practice pedagogy

This theme demonstrates the importance of the delivery method to our teacher participants. Syllabus insight is of utmost importance but if we cannot engage students in the content there is little chance that they will retain and apply the knowledge. Leithwood and Riehl (2003) second this notion, stating that teachers' instructional practices have been shown to have a significant effect on student learning. Engaging teachers in sharing what's working well for them has a real impact on their satisfaction during the professional development experience. For example, the opportunity to share insights, recipes, strategies and pedagogical experiences correlates with positive feedback in the course reviews. A sense of accomplishment and shared growth is present when teachers have the opportunity to offer their stories of success.

A major reason why this strategy is important for Food Technology teachers is that often, particularly in smaller schools, there may only be one Stage 6 Food Technology teacher. It can be isolating and lonely when you cannot share achievements and ideas with colleagues. Professional development experiences that allow teachers to share often allow teachers to get a wider understanding of how the subject is taught in different regions. It can also allow teachers to leave feeling proud of what they facilitate in their own schools. Participants have supported this in their NESA course evaluations stating:

> Networking with other teachers and discussions with the presenter on student engagement helped with implementing the strategies in my class.
>
> It helped to hear from colleagues their experiences and ideas.
>
> The provision, discussion of and practice of implementing suggested activities really helped my level of understanding and confidence.
>
> Networking with other teachers and discussing ideas and concerns.
>
> Participating in learning, professional networking, updating knowledge and targeting Stage 6 HSC Food Technology syllabus requirements with supporting current teaching resources were useful aspects of the course for me.

The communication, support and ideas shared in these professional development environments have encouraged participants to join an online social media sharing platform to continue sharing when the course is over. The community created is engaging and encouraging. The opportunity to share student work samples is also a favourable aspect and the articles, clips and information assist our teachers to stay current and relevant. Scott (2015) suggests that the collaborative learning environment challenges learners to express and defend their positions, and generate their own ideas based on reflection. Also, those learners discuss their ideas with peers; exchange different points of view; question others; seek clarification and participate in higher-order thinking, for example activities such as managing; organising; critical analysis; problem resolution and the creation of new learning and deeper understanding. If we are preparing our students for the future it makes sense that our professional development as teachers is collaborative, focused on best practice and innovation that is tried and tested.

d. Emerging technologies, future food, food science

It is understandable that this is an area where teachers are seeking guidance due to the ever-changing nature of these topics. As an evolving content area, textbooks cannot keep current, so teachers must seek reputable sources of information. NSW Education Standards Authority (2009) dictates in the Stage 6 Food Technology Syllabus that students must learn about emerging technologies in food production, manufacturing and packaging, including biotechnology in genetically modified foods. However, the truth about genetically modified foods and biotechnology, in general, is difficult to find due to its controversial nature. Participants complain that the information for these two emerging technologies often comes from overseas, America in particular, and it is often tainted by opinion and conspiracy theories.

Conner (2000, p. 2) agrees, stating although biotechnology education has gained recognition, "less is heard about how to teach effectively in areas that require sensitivities to moral, ethical and social dimensions which are linked to the use of technologies". Simmoneaux (2000, p. 619) investigated a similar question, namely "how should the content of biotechnology information be developed for the purpose of teaching today's students?" We asked our participants how they tackle teaching this complex subject. Some of the notable comments were:

> Current examples found in [1]Australian food news.
>
> Contact with people in the industry.
>
> Research new technologies before teaching and then get students to research from a vetted list.
>
> I am still struggling with this.
>
> I research a lot and then share this information with my students.
>
> I would like more current resources, it is hard to find resources that are new.
>
> Read a range of case studies and explore different examples available in the food industry.
>
> The pros and cons of each emerging technology are explored and discussed.
>
> Use of the internet, industry magazines.
>
> There is a lot of information about GM foods out there and kids are passionate about not interfering with nature. We look at pros and cons and try to get a balance. Linking it to prior knowledge assists.
>
> I personally struggle with this one. I think it would be best if we had access to some current reliable information that we could share with the students.
>
> I teach this with great difficulty and lots of YouTube videos.

It is apparent that our teachers require some guidance and assistance so that students obtain a consistent opportunity for learning such multifaceted concepts. NSW Education Standards Authority (2009) requires that students learn to investigate an emerging technology in one sector of the Australian food industry. The methods mentioned above by our survey participants—researching, sharing this research with students, and use of case studies—would assist in accomplishing this section of the syllabus. It is also required that students learn to discuss the potential risks and benefits of using emerging technologies in food production and manufacturing, which explains why participants commented about the pros and cons of discussion. Whilst many teachers have discussed viable approaches for teaching this concept, the removal of recommended reading lists and support documents from the Stage 6

Food Technology syllabus website leaves many teachers questioning their resources and the depth required to teach these topics effectively.

e. Technology Mandatory: Agriculture and Food Technologies

It makes sense that teachers are suffering from the woes of syllabus change or 'change fatigue' as it is commonly referred to. Change fatigue can be defined by its synonyms: being tired of change, adaptive failure, future shock and innovation fatigue (Dilkes, Cunningham, & Gray, 2014). For example, the Technology Mandatory syllabus has seen the joining of two subject areas, Agriculture and Food Technology, as well as the introduction of new topics not previously seen in Stage 4 Technology Mandatory, Engineering Systems and Digital Technologies. Due to begin for year 7 in 2019 and year 8 in 2020, there is plenty of adjustments to be made, and planning must occur to aid successful implementation.

Dilkes et al. (2014) support the notion of new syllabus anguish, stating that for decades, educational reform in Australia has been a quagmire of political and educational agendas. The introduction of a new syllabus increases the workload of teachers who are already feeling the pressure of increased responsibilities. Bernerth, Walker, and Harris (2011) agree that 'change fatigue' and exhaustion is, in turn, negatively related to organisational commitment and positively related to turnover intentions. In the face of frequent change, workers become less able or enthusiastic to implement successive reforms as the continual effort to do so reduces their personal resources.

The Happiness Mission® now offers courses for three of the different focus areas, Agriculture and Food Technologies, Engineering Systems, Material Technologies to assist teachers with implementation in 2019. Next year there will be a Digital Technologies course. The number of teachers who have attended these courses is staggering and significantly higher than our other courses. This is confirmation that teachers require guidance in the introduction of a new syllabus. The new concepts, particularly in the 'Learning Across the Curriculum' and 'Thinking Skills' requirements have encouraged more teachers to reach for 'outside' professional development.

NSW Education Standards Authority (2017) declare that the Technology Mandatory syllabus changes are consistent with the intent of the Melbourne Declaration on Educational Goals for Young Australians (Ministerial Council on Education, Employment, Training and Youth Affairs, 2008), which sets the direction for Australian schooling for the next 10 years. There are two broad goals. Goal 1: Australian schooling promotes equity and excellence. Goal 2: All young Australians become successful learners, confident and creative individuals and active and informed citizens. Whilst many teachers have expressed concern around the syllabus changes, the NSW Education Standards Authority (2017) claims that the new syllabus will provide students with the opportunity to investigate problems, generate ideas and produce sustainable solutions, and to develop skills and attitudes that are valued in our society and integral to Australia's economic future. There is no doubt that these changes are necessary for our students to contribute positively to society and to have similar opportunities to the other states students currently studying the Australian Curriculum.

f. Stage 5 (Years 9 and 10) Food Technology content specific (Fig. 13.2)

It displays participant responses for the question: The findings that teachers felt they had adequate resources were not surprising, due to the sheer volume of teachers who have attended our ‘Year 9 Food Tech Fun’ course and ‘Year 10 Food Technology Recharged’ course. However, there are still many teachers who feel their school is not equipped to teach Food Technology sufficiently.

The interesting elements of this response reside in the ‘other’ category. Some of the reasons that teachers selected ‘other’ were:

> Being a rural school, I feel we lack access to industry, i.e. Sydney Fish Markets
>
> We’re lacking computers, textbooks and space for practical and theory. Theory lessons are in kitchens, which makes it hard for productivity.
>
> We have all the basics to do a good job; however, it is all very dated, and the facilities need a really good revamp.
>
> I would like to challenge my students, complete more outdoor activities related to growing and producing food but the facilities are not available.
>
> Our school has great facilities for a country school, but I feel we are slightly disadvantaged due to the limited selection of seasonal food available.
>
> There is always a need for professional development, collegial meetings of the minds, and improving resources available to inspire students.
>
> We often struggle to complete food trends practicals like some of the city schools as we cannot source a large range of ingredients out here.

Educational inequity in rural schools became apparent when looking at the number of schools who did not believe they had adequate resources. ACARA (2018) supports this finding, stating NAPLAN results showed that students living in very remote areas of NSW are 18 times more likely to be below the national minimum standard in mathematics by Year 7 than a student living in metropolitan NSW. Across all five achievement domains, there is a consistent pattern in the results for Australia overall. Students attending schools in metropolitan locations have the highest mean score, followed first by students from provincial locations, second by students from remote locations and third by students from very remote locations. The Melbourne Declaration on Educational Goals for Young Australians sets out to provide all students with access to high-quality schooling that is free from discrimination based on

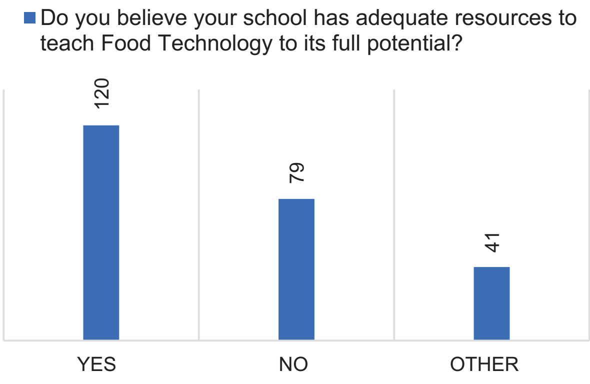

Fig. 13.2 Saunders (2018) ‘Do you believe your school has adequate resources to teach Food Technology to its full potential?’

geographic location (Ministerial Council on Education, Employment, Training and Youth Affairs, 2008) and so it is imperative that teachers have equal access to professional development. Therefore, we ensure that we present our courses in rural locations all over NSW. For teachers in remote locations, continued teacher professional development is necessary to ensure that their teaching methods, content knowledge and acquisition of skills remain current and equal to the teachers who work in metropolitan areas.

Considering the role of a Food Technology teacher in improving student literacy we asked our teacher participants to share a strategy, teaching style or activity that they do to help improve student's food literacy, knowledge and skills. This provided rich information about the way Food Technology is taught across a wide variety of NSW schools. Here are some of the enlightening responses:

> Posters on the wall to increase metalanguage.
>
> For functional properties of food, I read out a function and students must draw a picture to represent it. They then go back and write a sentence for each.
>
> Allowing students to describe their experiences with food and present a reflection on special occasions that involve food.
>
> Two sentence recap, students reflect on key points in what they have just read.
>
> Use of food media articles, games, bingo, quizzes.
>
> I use scaffolds to help students understand the NESA key terms.
>
> Prepare menus and food articles for a food magazine.
>
> Food product labels; in groups students look at different product labels to identify all the characteristics of a label. Students then design a food label for a recipe we have cooked.

Leithwood, Louis, Anderson, and Wahlstrom (2004) state Professional Development that focuses on teaching strategies associated with specific curriculum content and supports teacher learning within classroom contexts. This element includes an intentional focus on discipline-specific curriculum development and pedagogies in areas such as mathematics, science or literacy. Having teachers of the same subject area all in the same room creates a shared collaboration space that doesn't end when the day is over. The community built during the professional development day often continues online and the sharing between teachers is admirable. Notwithstanding this, providing teacher professional development courses that allow teachers to share their concerns, questions and potential ideas are imperative to relieve pressure and create a sense of ease. When asked 'What helped the implementation of your learning' by NESA in the 'Provider Course Evaluations', some notable participant replies were:

> Excellent presentation of resources, facility to question and discuss presentation aspects.
>
> They provided programs, resources and interesting ways to deliver the course. We also had the opportunity to share our ideas with other teachers.
>
> The presenter was amazing and answered all our questions and also allowed us to work together and practice implementing the material at our school.
>
> I was enriched by attending this workshop, it made it easier for me to write a new program for Technology (Mandatory) course. I was also able to interact with teachers from other schools and joined the Food Technology teachers' group for future support and networking.

> Break out activities and time spent with other teachers from my own department and from other schools throughout NSW. Group discussions were well led by course facilitators.

The appreciation of collaboration time was echoed through many of the course evaluations. Dilkes et al. (2014) found similar results in their study, stating that collaboration was highlighted for its contribution to the participants' coping strategies. By building on the seemingly natural resource of collaboration Dilkes et al. (2014) found it may be possible to help those suffering (or in danger of suffering) from burnout, change fatigue, demoralisation or other disposition problems, to become re-energised about implementing the mandated curriculum reform.

NESA is most concerned with how professional development impacts student learning. As part of the accreditation process, participants must comment on how attending the course has impacted their students. Some of the anonymous comments from the Provider Course Evaluation Report (NSW Education Standards Authority, 2018) were as follows:

> 'It has directly affected the way in which I have delivered the content making it more engaging for the students and therefore they are interacting with the content more'.
>
> 'Students have been fascinated with the new packages and food products I have shown them from the course. They valued the study guides, which were given to them which helped them organise and revise their notes'.
>
> 'Student engagement has increased and therefore their understanding of coursework'.
>
> 'Increased engagement of students and gaining feedback about learning immediately'.
>
> 'I have observed an increased motivation and engagement from all students but also myself. I am re-energised to teach this content. Students are excited and are talking about what they have learnt once they leave my classroom'.

After presenting over 100 courses, it is clear that teachers are willing learners who enjoy being actively engaged at a Teacher Professional Development course. Davidson, Goldberg, and Jones (2009) argue that there is a fundamental mismatch between the excitement generated by informal learning and routine learning so common to many systems of formal education. Professional development that builds on teacher's existing knowledge and experience is customised for the subject and is worthy of their time will be valued by teachers.

Conclusion

This chapter aims to examine the needs of teachers in preparing their Food Technology students for the future. If the professional development course provides quality resources that save teachers time, facilitates discussion about best practice and focuses on syllabus knowledge acquisition, it will generate positive feedback and will build on collaborative communities. This method of professional development can have an extensive impact on our students because teachers return to their classrooms with renewed energy and ideas. As a Teacher Professional Development company, we must use the feedback, comments and reviews to continually improve the service we provide to teachers. Pearson (2018) believes that student achievement is affected by three key elements—the student, the school and the home, and by far the most significant influencing factor in schools is the quality of the teacher. Continued teacher professional development, therefore, is essential for supporting the future needs of our students.

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Chapter 14
Food Teaching in Upper Secondary English Schools: Progression Into Food-Related Undergraduate Courses in Higher Education

Marion Rutland

Abstract The chapter looks at food teaching in English schools with specific reference to progression from the upper secondary school phase to undergraduate food-related courses in higher education and the loss of an Advanced (A)-Level Food Technology course (for pupils aged 16–18 years). Food education, known as cookery, domestic science, housecraft, home economics and food technology, is reviewed from the mid-nineteenth century to the introduction of the National Curriculum (DES. 1990). *Technology in the National curriculum*. London, UK: HMSO. A revision of the programmes of study in the English National Curriculum for Design and Technology (D&T) for pupils aged 5–14 years, (Department for Education (DfE), 2013). *Design and technology. Programmes of study for key stages* (pp. 1–3). London, UK: Department for Education and a reform of examinations for pupils aged 14–18 years (DfEa. 2014). *Reforming GCSE and a level subject content consultation*. London, UK: Department for Education all led to the loss of an A level food-related course.

A review of university undergraduate food-related courses (Rutland & Owen-Jackson, *Technology Education: Learning for Life*. Griffith University, Sydney, Australia, 2014) is followed by an investigation of A level courses taken by students before entry to food-related university undergraduate courses (Rutland, *A Level Subjects Taken Before Entry to Food-Related Degree Courses*. Unpublished research. Reading University: Department of Food and Nutritional Sciences, 2014). A small-scale research project (Rutland, The Academic Study of Food in the English Curriculum for Pupils Aged 16–18 Years: Its Demise and Future Prospects. In *PATT 37 – Conference 2019: Developing a Knowledge Economy Through Technology and Engineering Education* (pp. 373–380). University of Malta, Malta, 2019), based on the content of a new A Level food examination that could act as a pathway towards university courses and a range of employment in nutrition, dietetics, nursing, health-related professions, teaching and the food industry, is explored.

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The findings indicate an overall agreement for the composition and nutrition of food, the preservation of food to prolong self-life and the impact of new technologies. However, there was less support for the handling and preparation of food materials, the impact of the food industry and applied science and technology. It indicates an urgent need to clarify the content and assessment procedures based on the views of university course and admission tutors, the Design and Technology Association, the British Nutrition Foundation (BNF), the National STEM Learning Centre, examination boards and the DfE.

Keywords Food teaching in schools · Progression · Advanced-level examination course content · Entry requirements to food-based undergraduate university courses

The Introduction of Food in the English School Curriculum

The teaching of food as a philanthropic, utilitarian subject to prepare girls to run their home and housewifery or for paid domestic work was first introduced in the mid-nineteenth century English state elementary school system. It was not until the early twentieth century that domestic science, focusing on nutrition, was introduced in grammar schools for the more academically able girls. However, it essentially remained a practical subject with little attempt to teach underlying scientific principles (Rutland, 1997, 2006; Rutland & Owen-Jackson, 2015), thus reducing its educational value and acceptability as an entry qualification for academic courses in higher education (Rutland, 1984).

Up to the early 1970s, a domestic science GCE (General Certificate of Education) examination provided progression for pupils aged 16 years and an Advanced (A) Level GCE examination for pupils aged 18 years. Two main career opportunities for girls were available: one into non-graduate teacher training courses and another into household management and advising people how to run their homes efficiently, together with hospitality and catering. Housecraft, as a non-examination subject for the less academically able, focused on teaching girls to cook. In the early 1970s, there was a change of title to home economics with an increased emphasis on aspects of science and psychology (Owen-Jackson & Rutland, 2016).

1970s and 1980s

After the enactment of the Sex Discrimination Act (1975), food was taught to boys and girls as part of home economics, defined as the study of the needs of an individual in a community and the best use of human and physical resources in the context of home and family (Department of Science and Education (DES), 1978). This included learning to cook, feeding the family in a domestic context, consumer awareness, nutrition and the sources and function of food in our diet. There continued to be examination courses for pupils aged 14 years and 18 years, providing progression to a range of undergraduate degree courses in higher education.

The mid-1970s saw the introduction of undergraduate home economics degree courses as science-based BSc degrees, humanities-based BA courses and B.Ed. courses preparing future teachers. Thorne (1979) explored the employment opportunities sought by home economics graduates and found that they took one of two options: either educational/social or commercial occupations.

The early 1980s saw the introduction of the Nuffield Home Economics project (1977–1981), with a more scientific, investigative approach emphasising the physical, chemical and biological principles underlying craft skills. Food activities and investigations were included, but they were not directly related to, and linked with, practical cooking activities, methods and processes. Unfortunately, many home economics teachers were not qualified to teach and were least interested in these aspects of the subject, thus resulting in little long-term changes in classroom practice and the understanding of the practical application of the underpinning scientific principles by the pupils (Davies, 1981; Owen-Jackson & Rutland, 2016; Rodwell, 1983; Rutland, 1984).

The National Curriculum in England and Wales (DES, 1990)

The National Curriculum Technology in England and Wales was introduced as a compulsory subject for all pupils aged 5–16. It incorporated home economics into D&T as food technology, focusing on food as a material for designing and creating in contexts outside the home, but there were few examples of what this meant in practice (Rutland, 2006). In England and Wales, this change of emphasis to include food production outside home development confused many food technology teachers, and they were alienated by the requirements to 'fit' into the D&T curriculum and to align themselves with other material areas. For example, pupils were asked to 'design' food products by 'drawing and sketching' and using computer-aided design and computer-aided manufacturing (CAD/CAM) packages.

There was a lack of appreciation that 'designing' with food is a 'hands-on' activity to create and develop food products for specific purposes based on an understanding of scientific and technological principles and concepts. This involves practical activities, including investigations and the application of food properties and processes involved in food preparation and cooking (Rutland & Owen-Jackson, 2012a, 2012b). Bielby (2005) noted that there had been limited research into the food curriculum and there had been significant influence by examination boards on the process of 'designing' rather than on the development of food preparation knowledge and skills.

A report by the Office for Standards in Education, Children's and Skills (Ofsted) (Ofsted, 2006, p. 2) identified 'a lack of clarity about food technology and the relationship between the teaching of food as a life skill and the use of food as a medium for teaching D&T'. Too little time was spent on learning to cook nutritious meals (life skills) and too much time on low-level investigations and written work. However, it did note that 'in the best provision, pupils cooked or engaged in practical activity every week and theory was taught in a lively manner ... Pupils' research and analysis were tightly tailored to their product specifications that were demanding, realistic and, for older pupils, individualised' (Ofsted, 2006, p. 2). Food technology, if well taught, could teach both the practical skills of cooking and the broader skills of D&T, and students could embrace an understanding of the properties of food materials and apply this knowledge when developing food products. It was recommended that national bodies clarify the nature of food technology within the secondary school curriculum, but to the detriment of the subject, this never happened (Owen-Jackson & Rutland, 2016).

However, the introduction of food technology did increase the status of food teaching for pupils aged 5–18 years. A General Certificate of Education (GCSE) Food Technology examination was available for pupils aged 16 years, together with an A Level course for pupils aged 18 years, thus providing pupils with an understanding of food-related issues, preparing them for life in the twenty-first century and providing progression to food-related courses in further and higher education.

2013–2018

The increasing prevalence of 'obesity' in the UK became a major health issue for the government. One view is that teaching children 'cooking skills' or 'life skills' will ensure that they make healthy food choices, leading to a reduction in obesity. Yet it is known that multiple and complex factors contribute to obesity, for example socioeconomic conditions and the availability and accessibility of food. McGowan et al. (2015) note that there is limited dietary change related to an association between domestic cooking skills and food skills and that other psychological components (e.g. attitudes, food choice) and external barriers (e.g. budget, access to equipment, food storage etc.) need to be taken into account.

The 'Licence to Cook' initiative (2000–2009) was the first indication of the government's intention to focus on 'entitlement to cook' and 'life skills' in food education (Rutland, 2008). Funded by the Department for Education (DFE), it was to be integrated into the food technology curriculum for pupils aged 11–14 years but could also be delivered through after-school cooking clubs.

These dual, sometimes conflicting, strands of food teaching became a key issue in the 2013 review of the English National Curriculum for D&T for pupils aged 5–14 years. Food was retained within D&T with the inclusion of the term 'ingredients' and 'food'; however, there was a separate 'cooking and nutrition' section (DfE, 2013). Pupils were to work with food ingredients in the context of home and wider industrial settings and also were to 'learn how to cook', described as a 'crucial 'life skill'. It was not clear how learning to cook, without an understanding of ingredients, food science and modern food technologies, would prepare pupils for their future lives or employment in the twenty-first century (Rutland, 2017).

Food Examination Courses

Following the review of the D&T curriculum, all GCSE and A Level subjects (DfEa, 2014) were reformed. The DfE decided to develop a combined *GCSE Cooking and Nutrition*, with a name change later to *GCSE Food Preparation and Nutrition*; the new qualification would focus on ensuring that students acquire a good understanding of food and nutrition, as well as excellent cooking skills (DfE, 2015, pp. 6–7). The draft GCSE Subject Content for D&T (DfEb, 2014) did not include food as a material. All the former food courses, such as home economics, hospitality and catering and food technology, were to be addressed through one examination course. A new A Level Food Technology course providing a pathway for pupils aged 18 years and progression to higher education courses would not be developed, though a number of high-quality vocational qualifications, confectionary and butchery are available (DfE, 2014).

However, it can be argued that twenty-first-century lifestyles and the increasing availability of ready-prepared food products with the growth of the food industry have led to a change in eating habits and patterns. The food and drink industry is the UK's largest manufacturing sector, contributing £28.2 bn to the economy annually and employing 400,000 people (Food & Drink Federation (fdf), 2019). In addition to developing pupils' cooking skills, food teaching should focus on developing their knowledge and understanding of all aspects of food, including food science and technology and social, political and economic food issues (Lawson, 2013; Rutland & Owen-Jackson, 2013, 2014).

An example of the content of a new GCSE Food Preparation and Nutrition (Oxford, Cambridge and RSA (OCR), 2016) consists of nutrition, food provenance and food choice, cooking and food preparation and the skills required in preparation and cooking techniques. The assessment overview is as follows:

- Food Preparation and Nutrition – 50% written examination
- Food Investigation Task – 15% non-examined assessment assessing the scientific principles underlying the preparation and cooking of food
- Food Preparation Task – 35% non-examined assessment of the planning, preparation, cooking and presentation of food

GCSE emphasises knowledge of food science to be applied in Food Investigation and requires 'a review of findings and explanations of how these can be used when developing modifying and creating new dishes' (OCR, 2016, p. 22). It does not require the candidate to apply their knowledge of food science in Food Preparation Task, which assesses the planning, preparation, cooking and presentation of food.

There is no mention of food technology or of the concept that food product development is a 'technological outcome' or a process of applying technical knowledge.

Overall, the course focuses on the general and vocational aspects of food education and the 'life skill' of cooking. It emphasises the development of food preparation skills and prepares pupils to cook food at home and for an employment in the hospitality and catering industry, but there are questions on whether it provides progression to employment in the food industry and food-related undergraduate courses in higher education.

University Food-Based Undergraduate Courses

Research carried out in 2014 (Rutland & Owen-Jackson) explored the appropriateness of the food technology school curriculum as preparation for progression to higher education. The research question was:

> 'What is the course content of university food-technology related courses?'

Data were collected through a survey of university-level food technology course content, and course information was found via a web search of The Complete University Guide http://www.thecompleteuniversityguide.co.uk/league tables/rankings?s=Food%20Science.

Thirty-six universities were listed; the top ten were selected for consideration. Only undergraduate courses were considered. Courses were found that related to food science, aspects of food technology and food and nutrition, so these three categories were used for analysis. The names of the courses (Table 14.1) were noted alongside the entry requirements and an outline of the course content.

Food and Nutrition was the most popular course. There were some links between the A Level specification and the undergraduate degree courses, for example in *Food Technology and Bioprocessing* (Reading University): food processing, food product development, food quality assurance and safety and sensory evaluation; similarly, in *Food Science*: aspects of microbiology, food processing and food quality and safety; and in *Nutrition*: food product development, nutrition and health, sensory evaluation. Seven courses included food safety and hygiene and food product design/development; four taught food processing and food issues and three food analysis/evaluation.

The study showed that there are differences amongst the A Level Food Technology specifications and that different courses may have been appropriate for pupils with different career aspirations such as *nutrition, food product development and food manufacturing*. However, it was clear that the current A Level Food Technology courses alone were considered insufficient preparation for a university entrance. The subject is so vast that it cannot all be covered in one subject on the school timetable, but in combination with chemistry and/or biology (depending on the aspiration), the A Level in Food Technology should not be dismissed.

Table 14.1 Entry requirement and content of university undergraduate food-related courses

Entry requirement	Content
Food technology: 1 course	
Reading University: 2 core sciences (chemistry, physics, biology, mathematics) Other sciences: further mathematics, statistics, psychology, geography, environmental science, applied science and geology Food technology not mentioned	Year 1: Foundations of chemistry, microbes and microbiology, cell biology Development of mathematical and computing knowledge and skills Later – microbiology, biochemistry, revisited aspects of enzymology food processing, food product development, food QA and safety and sensory evaluation
Food science: 6 courses	
Leeds: the only one that referred to food technology/home economics as a suitable A level courses	Microbes, microbiology, food processing, food quality and safety, food product development, food quality and assurance and sensory analysis All courses taught nutrition, plus cell biology, molecular biology, biochemistry/food chemistry, food production and sensory evaluation Some taught food colloids, bioethics, food materials/ingredients, food and health and physiology
Food and nutrition: 18 courses	
Entry with science subjects – some naming the subject, others only requiring 'science'; four universities named food/technology/home economics as acceptable *Leeds*: (nutrition) 'considered' *Nottingham*: (nutrition) an acceptable science subject *Newcastle* (food and human nutrition) considered in place of biology *Coventry*: (food and nutrition) food technology acceptable *University of Ulster*: home economics acceptable as a science	A high level of commonality: all taught some aspects of microbiology, cell biology or molecular biology; biochemistry and chemistry (7); physiology (12) and endocrinology (3); nutrition and health (11); clinical nutrition (3); applied nutrition (2); diet therapy/dietetics (2); sport and exercise nutrition (3); food safety/hygiene (7); psychology (5); consumer behaviour (3); nutrition/health (9); food product design/development (7); food processing (4); food analysis/evaluation (3); food marketing (1) and food issues (4) Single modules in food services and catering, food origins, food policy and eating disorders

A Level Subjects Taken by Students Before Entry to Food-Related Undergraduate Degree Courses

Alongside A Level Food Technology, it is important to consider the other A Level courses studied by students before entry to food-related undergraduate degrees. A questionnaire was completed by 77 year 1 students in the Department of Food and Nutritional Sciences at Reading University (Rutland, 2014).

It was found that the A Levels studied by the students before entry to their degrees were mainly science subjects:

- BSc Nutrition and Food Science: biology (28), chemistry (18), mathematics (8) and food technology (8)

- BSc Nutrition with Food Consumer Sciences: biology (12), chemistry (5), mathematics (4) and food technology (4)
- BSc Food Science: biology (9), chemistry (10), mathematics (3) and food technology (3)
- BSc Food Science with Business: biology (2), chemistry (5), mathematics (4) and food technology (3)
- BSc Food Technology with Bioprocessing: biology (2), chemistry (1), mathematics (1) and food technology (1)

The range of other A Level courses taken was broad, with the most popular being psychology and German. Biology (57) was the most popular A Level subject taken by students, followed by chemistry (57) and mathematics (32) as the second and third most popular, respectively, and, interestingly, food technology (19) the fourth. This was despite the lack of direct reference to food technology as an entry requirement (Rutland & Owen-Jackson, 2014). There was an acknowledgment by the admission tutor that there was a need for some revisions for a new A Level Food Technology course to make it more appropriate to the course content followed by undergraduates at Reading. However, the research indicated that an appropriate food-related A Level food course would be acceptable for entry to an undergraduate food-related degree, together with science subjects.

Exploring Views of a Draft of a New A Level Food Examination

A new A Level examination that could be considered as a pathway and progression to university courses and employment in nutrition, dietetics, nursing, health-related professions, teaching and the food industry was drafted (Rutland, 2019). The aim was to explore the potential content of a new food-based A Level examination for pupils aged 16–18 years in England. A major source of information is the book 'The Science and Technology of Foods' (Proudlove, 2009). The proposed title for the course was Food Science and Technology. The content was divided into three sections (Table 14.2).

Table 14.3 indicates the range of respondents. In total, 67 people responded, including a majority (55.22% + 11.96% + 2.99% = 69.85%) of school teachers with an additional 28.36% with middle management positions in schools.

The respondents were asked to comment on the content (Table 14.4):

- Was it sufficient?
- Should it be reduced?
- Should content be added?

The results in Table 14.4 showed a general agreement with the content of the draft A Level food-based examination. The highest responses for sufficient content were the composition and nutrition of food (89.47%), preparation and cooking food

Table 14.2 Potential content of a new A level food examination

Food consumption
The composition and nutrition of food: water, carbohydrates, lipids (fats), proteins, minerals, vitamins, pigments, flavours, additives and fortified and functional food
Human dietary and health studies: types and functions of nutrients, digestion and absorption, nutritional product analysis, nutritional labelling
Consumer choice: connections between food constituents, diet and health to understand the variability and diversity of psychological behaviour; political, cultural and social issues; changing eating patterns; obesity; malnutrition; undernutrition; emerging trends; market research
Influences of the food industry: impact on the health of highly processed food, ready meals, increasing consumption of fast food, advertising, promotion and marketing techniques
Food production
National and global issues – population growth and food supplies: food sources (animal, plant, fungi; sustainability of food, food miles, synthetic food, biotechnology of food, functional food, organic food, genetically engineered food, modification), new food sources and technologies
Environmental challenges: production of biofuels, growing demand for major food crops like wheat and rice, livestock health, production to deliver improved food security and farming sustainability, increase of factory farming, new agricultural technologies, impact of automation on food production
Handling and preparation of food materials: storage of raw materials; cleaning, sorting and grading; size reduction; mixing, filtration and blanching; distribution; and transportation of food
Preservation of food to prolong shelf life and prevent spoilage and contamination: microbiology (bacteria, moulds, yeasts, algae and viruses); food spoilage caused by yeasts, moulds and bacteria; preserving food (e.g. heat processes, chilling, freezing, canning, dehydration, UHT, irradiation, modified atmosphere packaging); food safety and hygiene (food hygiene, poisoning and cross-contamination)
Food processing
Ingredients and commodities: dairy products, meat, fish, poultry and eggs, fruit and vegetable, cereals and baked products (bread, cakes, biscuits and pastry), beverages, chocolate and confectionary
Physical and chemical working properties of ingredients: colloidal structures/systems of food (e.g. sols, gels, emulsions, foams), changes that take place during preparation and cooking (e.g. gelatinisation, coagulation, caramelisation, Maillard reaction, emulsification, fermentation, antioxidation), enzymatic changes in the production of bread, beer and wine, raising agents (yeast, chemicals)
Preparation and cooking of food products: use of a range of processes and skills, choice and use of ingredients for desired characteristics (e.g. shortening), effects of heat on different foods, use of heat transfer (e.g. radiation, convection, conduction), food safety and hygiene, sensory properties of food (flavour, odour, colour, texture and appearance)
Applied food science and technology: product design and development, manufacturing and processing, analysis, quality control and quality assurance, biotechnology and innovation in food product development
Awareness of industrial practices: manufacturing processes (product specifications, food control and safety, quality control and quality assurance, risk assessment and HACCP), transportation of food
Impact of new technologies: novel ingredients and processes, nanotechnology/packaging of food

Table 14.3 The range of respondents completing the questionnaire

School teacher 11–18	55.22%
School teacher 11–16	11.94%
Sixth-form/college teacher 16–18	2.99%
Student teacher	16.42%
Head of D&T/food department in a school or college	28.36%
School-based teacher trainer	5.97%
PGCE/education lecturer (teacher trainer)	2.99%
Other university lecturers (please note discipline in box below)	1.49%
Food science/technology professional (please note detail in box below)	2.99%
Others: BSc Nutrition student; nutritionists (2); technicians (2); worker in a hospital and special education; founder of the Food Teachers Centre	10.45%

Table 14.4 Summary of responses to the questionnaire

	Sufficient content (%)	Reduce content (%)	Add content (%)
Food consumption			
The composition and nutrition of food	89.47	3.51	7.08
Human dietary and health studies	82.46	1.75	15.79
Consumer choice	75.0	7.14	17.86
Influences of the food industry	66.0	3.57	30.36
Food production			
National and global issues: Population growth and food supplies	83.64	3.64	12.73
Environmental challenges	72.73	5.45	21.82
Handling and preparation of food materials	70.91	23.64	5.45
Preservation of food to prolong shelf life and prevent spoilage and contamination	87.04	3.70	9.26
Food processing			
Ingredients and commodities	86.79	3.77	9.43
Physical and chemical working properties of ingredients	85.19	5.56	9.26
Preparation and cooking of food products	87.04	1.85	11.11
Applied food science and technology	73.58	22.64	3.77
Awareness of industrial practices	81.13	16.98	1.89
Impact of new technologies	87.04	7.41	5.56

products (87.04%), preservation of food to prolong shelf life and prevent spoilage and contamination (87.04%) and the impact of new technologies (87.04%). The influences of the food industry response (66.0%) was the lowest. The handling and preparation of food materials (23.64%) scored the highest for reducing content. Influences of the food industry scored the highest (30.36%) in add content, followed by environmental challenges (21.82%). A reduction of applied science and technology (87.04%) and awareness of industrial practices (16.98%) were significant as they indicated a lack of understanding of the importance of food production outside the home.

Key Issues/Issues Arising in the Food Consumption Section

a. The Composition and Nutrition of Food

Issues such as energy and pigments should be added with an increased clarity of the level and detail on what should be taught. The new GCSE Food and Nutrition contains drinks (milk, juices and soft drinks), and they should be in this draft.

b. Human Dietary and Health Studies

There should be a section on diet-related conditions, e.g. coeliac, diabetes, osteoporosis, CHD, high blood pressure etc. A reduced focus on digestion and absorption should be considered, and they should be kept for 'degree' level as a lot of students would struggle with such content. The relationship between nutrients and science should be taught together with a focus on product analysis and labelling.

c. Consumer Choice

Animal welfare issues should be included, together with political, social, cultural and environmental issues. Students should be aware of the moral issues linked to food cost and choices, for example intensive farming. The in-depth focus on special diets was approved. The section provided much to think about and made links with modern-day concerns, for example obesity and the impact of marketing and social media on food trends. There was a need to clarify 'variability and diversity of psychological behaviour'. Overall, the draft provided progression from the new GCSE, and it was good to see emerging trends and market research included.

d. Influences of the Food Industry

This area will grow in importance, and improving the quality of food products should be linked to food choices and the treatment of animals in factory farming. Social, economic and technological factors should be explored, including the impact of processed food in our health and diet, consumer choice and the impact of social media, funding sources for the industry and the marketing of such food. Some influences and technological developments have been more beneficial, for example nutraceutical, sustainable food sources for the future (such as insects), 3D printing in food to produce new ways of cooking at home and new advances in food products.

Key Views/Issues Arising in the Food Production Section

a. National and Global Issues

This section builds well on the current GCSE, with a large section on food science, food provenance and sustainability. The inclusion of political and medical issues and their effects on food supply and distribution was considered to be good, e.g. animal agriculture, antibiotic resistance, possible solutions of food waste issues and food security.

b. Environmental Challenges

Food provenance is important, including ‘farm to food’, seasonal produce, food waste, global warming/climate change and its impact on food production and diets. New sources of proteins, more environmental-friendly ways of growing crops and the impact of intensive farming on us and other parts of the world (for example, environmental degradation due to palm oil deforestation in Indonesia and loss of South American rainforest to make way for avocado plantations) were all important. The impact of animal agriculture on land and plant crops (wheat and soya) and the need for ‘feed’ crops all added to food insecurity and act as a main driver for habitat loss and species extinction. Ethical issues such as human slavery and child labour in food production should be included.

On the other hand, some respondents thought that this should be discussed in less detail as it is less relevant for 16–18-year-olds and that there should be a greater focus on nutrition. Food security factory farming and the technology used in food production should be kept but would be better placed outside the new qualification.

c. Handling and Preparation of Food Materials

The inclusion of food hygiene standards and preservation was supported, but there should be less focus on the storage and distribution of raw materials and technology processes. Some views expressed were as follows: ‘these issues probably need to be there but it sounds dull to teach and learn about! … they need to be discussed but at a basic level and then developed in depth at post-18 level.’ ‘I am unsure if it is particularly relevant’, and it could be touched on but not in too much depth. On the other hand, ‘it builds on the new GCSE, which looks at primary and secondary processing as well as small scale practical preparation and the inclusion of bulk manufacturing/processing. It is a step forward.’

d. Preservation of Food to Prolong Shelf Life and Prevent Spoilage

It was thought that although this was examined in the current GCSE, it would be good to see the additional depth and this was good progression from the food science element in new GCSE specification. Food safety, hygiene and spoilage should be in separate sections, along with microbiology, food safety and hygiene.

Key Views/Issues Arising in the Food Processing Section

a. Ingredients and Commodities

This is in the new GCSE, but not about commercial food processing. Carbohydrate-based food such as legumes; grains; pasta; rice; fats and oil; alternative proteins, e.g. Quorn; and novel food/vegetarian alternatives should be included. One responder thought that beverages, chocolate and confectionery and wine/beer should be removed, but another agreed that it should be there. There should be a greater encouragement to look at healthier alternatives in a balanced teaching programme, as part of the 'mix' but not as the main focus.

b. Physical and Chemical Working Properties of Ingredients

This is the basis of food science. The new GCSE covers this in some depth and requires students to design investigations: what more will be added? On the other hand, it shows good progression from the food science element in GCSE, but more specific scientific scenarios are needed.

c. Preparation and Cooking of Food Products

The content is similar to the new GCSE, so additional depth would be required. The practical food preparation element of the course is very popular with some students, and so high-level skills should be included.

d. Applied Food Science and Technology

One respondent asked if applied food science and technology was relevant for an A Level. They thought that the content should follow directly on from the new GSCE, where design and product development has been taken out, so there should be less of manufacturing and production and more of food preparation and nutrition rather than food technology. On the other hand, another respondent's view was that applied food science and technology were important as they showed progression and a 'shift' away from the GCSE Food Preparation and Nutrition specification. Also, food styling and batch production should be included.

e. Awareness of Industrial Practices

A few respondents thought that less emphasis on this was needed at A Level, and its relevance and appropriateness were questioned. Content should follow directly on from the new GSCE, where design and product development was taken out, with a reduced emphasis on manufacturing processes and an increase on nutrition and diet. However, this was not a common response.

f. Impact of New Technologies

It was thought that this makes the content modern, although it should be more clearly defined than in the previous Food Technology GSCE/A Level. It is the future of food manufacture, but it is a difficult subject to teach in the classroom.

Do You Think That There Should Be an A Level Food-Based Course?

The response to the question on whether there should be an A Level food course was 'Yes' (100%), which was encouraging. Suggestions for titles were very broad; keywords included food; nutrition; science and technology, followed by the less popular preparation; diet/health; the future; development; production; manufacture and industry; and home economics. It was thought that ‘Food Science and Nutrition’ should be avoided as there is already an examination title at this level. One view was that there should be two courses, one focusing on decorative techniques and the practicalities of working in the food industry and one on nutrition and health.

Assessment Procedures

A percentage of 92.31 agreed and 7.69 disagreed that a written examination should have short-structured questions for Paper 1 and longer essay-type questions for Paper 2. Preferences were for short-structured examination questions with course work and practical work, for example small units combined with a demonstration of practical skills or one combined paper.

Non-examination Assessment (NEA)

A total of 80.85% supported a product development project (74.47%), a case study (74.47%), an investigation (91.11%) and a presentation of specific issues or topics (80.95%). Comments included the need for some practical and experimental food work, the development of alternative ingredients, a food science experiment option, a production problem, the inclusion of practical skills, case studies of diet-related issues, a brief to test high-level skills or moving away from assessing mainly food skills.

Suggestions for Alternative Framework

These included two projects over the course, a mini project or an independent study with some experience of the type of work done in a degree course, a compulsory NEA product development project or research on topical issues as an option tailored more to students’ interest, e.g. nutrition, food science or food industry. Examples of these alternative frameworks are case studies of artisan food producers, investigations into school meal menus, presentations on famine or food waste (global perspective) or an industrial research/work/placement with local businesses. It was considered important to retain the ‘development of thinking and creative skills to design with imagination’.

A total of 32 respondents showed an interest in being involved in future developments.

Conclusions

This chapter has looked at the background of food education in England from the time of its introduction up to the situation in schools in 2019. The main focus has been on the need to develop a new A Level food course that would provide progression for pupils aged 16–18 years who are interested in food and want to continue their studies in higher education or follow courses leading to careers such as nutrition, dietetics, nursing, health-related professions, teaching and the food industry within an informed knowledge economy.

The recent report on food education, ‘Food Education Learning Landscape’ (FELL), adopted a whole school approach based on ‘learning the basics of food, where it comes from, how to cook it and how it affects their bodies in food teaching in England’ (Oliver, 2017, p. 6). The findings are grouped into three themes: curriculum (formal food education), culture (how a whole school approach supports food education) and choice (the food behaviour that children are adopting). This approach is very important, but it focuses on whole school managerial procedures and approaches rather than on actual ‘food teaching’ in the school curriculum. Though many secondary schools offer the new GCSE, overall the number of students continuing to study food in the curriculum beyond year 8 is in decline. Also, ‘teachers are concerned about the removal of an A level “food” qualification in England and Wales, which negatively affects the status of the food in schools and limits career prospects in this area’ (Ballam, 2018, p. 8).

It is important for the teaching of food in schools in England that a new A Level food course be re-introduced. It is a lost opportunity for food education in schools. It should address the interests of pupils wanting to study food-related courses in preparation for professional and research careers in the food sector and be acceptable as an entry requirement into courses in higher education, together with science subjects.

The chapter has looked at course content, entry requirements to food-related undergraduate courses, the A Levels taken by university students on food-related courses and the views on a draft for a new A Level course. A wider perspective is needed for a new course, that is validated by the DfE, to fully prepare pupils for a successful entry to undergraduate food-related courses. There may be a need for ‘options’ within the assessment programme for schools and students to choose from to take into account the broad range of the food curriculum. The food we eat directly relate to the health of our communities, and how it is produced has a direct influence on the future of the planet. More clarity on course content and assessment procedures is needed, and there is an urgent need to draw together a group of professionally interested people and organizations, including the Design and Technology Association, the British Nutrition Foundation (BNF), the National STEM Learning Centre, teachers, university course lecturers, admission tutors and examination boards to explore the issues involved in the food enterprise.

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Part III
Current Content and Contemporary Issues

Chapter 15
Current Research in Nutrition in the School Curriculum in England

Sue Reeves

Abstract Good nutrition is fundamental for health and well-being. Given the increasing levels of obesity in the United Kingdom, it is important that food and nutrition are taught from a young age. The school curriculum can ensure that pupils have the knowledge to make healthy choices, whilst the school environment can play a role in ensuring that pupils have the opportunities to make healthy choices. Food and nutrition in the school curriculum must be grounded in evidence-based guidelines that consider current nutrition information and how nutrition knowledge can be applied. The curriculum should include the fundamentals of energy balance and nutrient requirements; describe a balanced diet; consider public health, obesity and related co-morbidities; consider food journeys from farm to fork; and consider food safety and the application of nutrition knowledge. New areas for nutrition research, such as the role of the gut microbiome in health and disease, sustainability and global food security, can also be embedded into the curriculum to ensure that teaching is up to date and relevant. Using research to enhance the teaching of food and nutrition in schools, we can ensure that pupils have the knowledge they need to make healthy food choices to protect their health in the short and long terms.

Keywords Nutrition · Food · National curriculum · Life skills · Public health · Research · Obesity

Introduction

Good food and nutrition are fundamental for health and well-being. An appropriate diet can provide energy, support growth, the immune system and cognitive development, and prevent obesity and non-communicable diseases such as diabetes and cardiovascular disease. Given that eating habits are shaped at a young age

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(De Costa, Moller, Frost, & Olse, 2017), it is important that children are given opportunities to learn and understand the role of food and nutrition in health. Schools are an important setting where children and young people can be informed about food and nutrition. However, it is important to ensure that the food and nutrition curriculum is based on evidence-based information and is kept up to date to reflect advances in the field. Therefore, this chapter aims to explore developments in nutrition research and how they can be used to help shape and strengthen the teaching of food and nutrition in schools.

The increase in the rates of overweight and obesity in the United Kingdom (UK) has been well documented (National Health Service (NHS), 2018; Organisation for Economic Co-operation and Development (OECD), 2017). Data from the UK National Child Measurement Programme showed that a quarter of children entering primary school are overweight or obese, rising to one third by the end of primary school (Public Health England (PHE), 2018). Schools have been identified as a key setting for interventions and education (World Health Organization (WHO), 2009) since they can offer a framework for educating pupils about nutrition and healthy eating and about the importance of physical activity, as well as facilitate the implementation of food standards (Story, Nanney, & Schwartz, 2009). Dietary habits learned in childhood are often continued into adulthood (Lien, Lytle, & Klepp, 2001), and therefore childhood is a crucial time for developing lifelong healthy eating patterns (Sadegholvad, Yeatman, Parrish, & Worlsey, 2017). Tull (2018) recommends that food education be taught in schools to develop food knowledge and preparation skills, understand the relationship between diet and health and develop independence and life skills. Furthermore, nutrition education has been shown to contribute to healthy eating in and out of school, and this may also help reduce the risk of childhood and adult obesity (Contento, 2012; Hayes, Contento, & Weekly, 2018), further emphasising the importance of teaching food and nutrition in schools.

The Teaching of Nutrition in the School Curriculum in England

There have been many changes to how food education is taught in schools since it was first introduced into the school curriculum (Rutland, 1997); subsequently, food and nutrition is now taught in different areas of the school curriculum. It is presented as a life skill in Personal, Social, Health and Economic Education (PSHE) and as an academic subject in Science. It is a compulsory part of the Design & Technology (D&T) National Curriculum for pupils aged 5–14 years, where under the heading Cooking and Nutrition, it is stated that ‘as part of their work with food, pupils should be taught how to cook and apply the principles of nutrition and healthy eating’ (Department for Education (DfE), 2013; Rutland, 2017) (see Table 15.1). Furthermore, the geography curriculum features food and farming, and physical education may also include reference to nutrition as a key part of overall health and well-being (Department of Education, 2014). There is currently a General Certificate

Table 15.1 National curriculum in England: design and technology programmes of study (Department for Education, 2013)

Cooking and nutrition
As part of their work with food, pupils should be taught how to cook and apply the principles of nutrition and healthy eating. Instilling a love of cooking in pupils will also open the door to one of the great expressions of human creativity. Learning how to cook is a crucial life skill that enables pupils to feed themselves and others affordably and well, now and in later life
Pupils should be taught to:
Key stage 1
• Use the basic principles of a healthy and varied diet to prepare dishes
• Understand where food comes from
Key stage 2
• Understand and apply the principles of a healthy and varied diet
• Prepare and cook a variety of predominantly savoury dishes using a range of cooking techniques
• Understand seasonality, and know where and how a variety of ingredients are grown, reared, caught and processed
Key stage 3
• Understand and apply the principles of nutrition and health
• Cook a repertoire of predominantly savoury dishes so that they are able to feed themselves and others a healthy and varied diet
• Become competent in a range of cooking techniques (for example, selecting and preparing ingredients, using utensils and electrical equipment, applying heat in different ways, using awareness of taste, texture and smell to decide how to season dishes and combine ingredients, adapting and using their own recipes)
• Understand the source, seasonality and characteristics of a broad range of ingredients

of Secondary Education (GCSE) in *Food Preparation and Nutrition*, which according to Ballam (2018) was offered as an optional subject for pupils aged 14–16 years in 76% of secondary schools, though it was noted that the numbers of pupils taking this option were declining. However, the A level food qualification was not redeveloped in England and Wales, the last cohorts completing in 2018.

Although the updated National Curriculum for England requires all children and young people aged 5–14 years in maintained schools to study Cooking and Nutrition (Department for Education, 2014), how this is implemented varies from school to school. A recent British Nutrition Foundation (BNF) study found no evidence of change in the amount of cooking classes offered in schools since its introduction (Ballam, 2018). The Jamie Oliver Food Foundation, the British Nutrition Foundation (BNF), the Food Teachers Centre and the University of Sheffield published a report entitled ‘Food Education and Learning Landscape’ (FELL), which reviewed food education in schools (BNF, 2017). Their findings revealed large discrepancies in the quality of food education between schools, many of whom identified barriers such as resources, time and a lack of support. There were also concerns about the whole-school food environment that did not always allow children to be able to make good food choices. The report went on to recommend that schools should provide a healthy food environment and that more support should be available. In addition to this report, the British Nutrition Foundation (BNF) conducted a national survey in schools to investigate knowledge of food and nutrition in order to identify what young people know about cooking, healthy eating, food sources and physical activity (Ballam, 2017). Five thousand and forty young people aged 5–16 years participated in the study. Findings showed that in all age groups there was a clear lack of understanding as to where food originates. The findings revealed that 18% of children thought that fish fingers were made of chicken, and 10% of pupils aged 11–14 years did not know that potatoes and carrots grew underground. Amongst primary school children, there was also a lack of knowledge about the Public Health England's Eatwell Guide (see Fig. 15.1). The survey revealed that the children got much of their nutrition information from the Internet, which is of variable quality, and hence there is a need to ensure that they are provided with up-to-date, evidence-based information through the school curriculum (Ballam, 2017).

Other research has shown that the majority of children in England do not consume the recommended amounts of fruit and vegetables; in 2016, 16% of children aged 5–15 years consumed five or more portions (Health Survey for England, 2016), and the average consumption was 3.1 portions per day. Schools that have engaged with programmes such as 'Food for Life' (Soil Association, 2019), which is a whole-school multicomponent intervention, have shown evidence for increased consumption of healthy food, with schools engaged with the 'Food for Life'

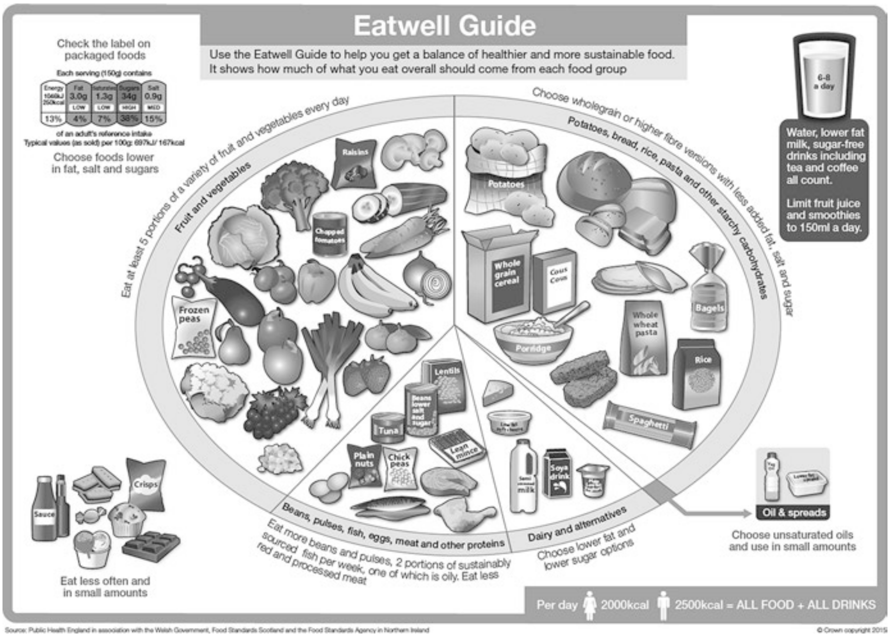

Fig. 15.1 The Eatwell Guide (Public Health England in association with the Welsh government, Food Standards Scotland and the Food Standards Agency in Northern Ireland; Crown Copyright, 2015)

programme in particular being found to be twice as likely to eat five or more portions of fruit and vegetables in comparison with other schools (Jones et al., 2017), again highlighting the importance of nutrition education for increasing healthy eating in and out of school.

The School Food Plan, published by the Department for Education in July 2013 (Dimbleby & Vincent, 2013), included a major review of school food in England and laid out actions to be implemented. These actions included adding cooking into the curriculum of children aged 4–14 years, introducing food-based standards for schools. Increasing the take up of good school food, establishing financial self-sufficient breakfast clubs, investigating extending free school meal entitlement (around the same time universal free school meals were offered to all pupils in reception year 1 & 2), training Head teachers and for Ofsted inspectors to consider behaviour and culture in the dining hall. The School Food Plan was never evaluated and in 2016 it came to an end, and a School Food Plan Alliance was established as a charity organisation independent of government funding (Scott, 2016).

The School Environment

The school environment also plays an important role in the development of healthy eating habits and may even compromise the pupil's ability to make the healthiest food and drink choices. In August 2016, the UK government published Childhood Obesity: A Plan for Action (Her Majesty's (HM) Government, 2016); as part of this report, plans were laid out for Ofsted to review levels of obesity, healthy eating and physical activity in schools (Ofsted, 2018). Their findings showed that some schools were constrained by their facilities, but 90% of schools that were visited had a full production kitchen (Ofsted, 2018).

Food served in schools in England is required to meet the School Food Standards (Dimbleby & Vincent, 2013) to ensure healthy balanced meals. The meals must provide fruit and vegetables, bread, cereals and/or potatoes and high-quality meat or fish. No more than two portions of deep fried, breaded or battered food can be served each week, and no chocolate crisps, sweets or drinks with added sugar can be sold in canteens or vending machines (School Food Plan, 2013). However, the take-up of school meals is low at 43% (Ofsted, 2018), and this includes the increase that occurred with the government's introduction of free lunches for all infants (George, 2018). In older children, the decision to eat lunch at school may depend upon the facilities. Sometimes there are space restrictions and long queues, and the dining rooms can be described as dark and gloomy (Ofsted, 2018). Some pupils report school canteens as being noisy, unpleasant and with little food choice, and therefore they prefer to eat elsewhere (Wills et al., 2013). Older pupils may be more likely to leave the school premises at lunchtime and buy food and drink from local shops, supermarkets and fast-food takeaway outlets (Macdiarmid et al., 2015). Studies have shown that where children have permission to leave the school premises at lunchtime, at least 97% of them will purchase food and drink and that products bought outside of school can contribute up to 23% of pupil's energy intakes (Sinclair & Winkler, 2008). Whilst pupils do recognise that food served in schools is usually healthier, it has been reported that healthy items sold in schools were expensive and it may be considered 'uncool' to be seen queueing for school food (Caraher et al., 2016).

Whilst nutrient- and food-based standards exist for school dinners, no such standards exist for packed lunches. Ofsted (2018) reports that 44% of pupils in England have a packed lunch, and nutritional studies have found that packed lunches typically have lower nutrient profiles than school lunches (Stevens, Nicholas, Wood, & Newlson, 2013). Children who have packed lunches have also been found to consume higher sugar and salt intakes and lower fibre levels and generally eat a less healthy diet over the entire day (Evans, Mandl, Christian, & Cade, 2015). It has been suggested that there should be food-based standards for packed lunches, as well as recommendations to improve intakes of a few nutrients, namely vitamin C, iron and folate, which are often lacking in packed lunches (Evans & Cade, 2016).

Schools should support the development of a healthy food environment on the premises that extend beyond school lunches to include all food served in breakfast clubs, after-school clubs, tuck shops and vending machines, as well as snacks consumed at break times (Weichselbaum & Butriss, 2014). The whole-school approach recognises that children are more likely to adopt healthier behaviours if the taught curriculum is supported by the same message within the ethos and environment of the school and its local community (Denman, Moon, Parsons, & Stears, 2001; Department for Education & Skills (DfES), 2004; Robinson, 2006).

Nutrition Research to Strengthen the Teaching of Food and Nutrition in Schools

Given that nutrition is taught in schools in various parts of the curriculum and supported by the school environment, the question is how to ensure that the information is current and reflects the latest research findings. Food and nutrition, like all STEM (science, technology, engineering and math) subjects, relies on the scientific method to shape knowledge of the complex links between food, nutrients and health. Nutrition is a scientific subject, and rigorous methods are used for research investigations in this area. It could be argued that nutrition is a relatively new science. Up until the year 1900, nutrition research largely focused on energetics and calories (Hargrove, 2006; Holmes, 1985). However, in the years that followed, scientists started to comprehend that there were other components essential for a healthy diet, such as micronutrients, and that individual dietary components could play a role in the prevention or development of chronic disease. In the wake of both world wars, there was a greater understanding of the role of diet and the importance of appropriate rations for soldiers on the front line, as well as the general population, and subsequently nutrition research flourished (Huxley, Lloyd, Goldacre, & Neil, 2000). Thereafter, there was a move from focusing on single nutrients to focusing on overall diets in relation to chronic disease and the health of the nation, particularly since there seems to be a transition from traditional diet rich in wholegrains, fruits and vegetables to a more processed energy-dense diet (Popkin, Adair, & Ng, 2012). This nutrition transition has led to the 'double burden of malnutrition', which has been characterised by the World Health Organization (WHO) as the coexistence of under-nutrition, along with obesity, and diet-related non-communicable diseases, which can affect individuals and populations and people of all ages (WHO, 2018).

Public health nutrition has never been more important, with increases in the rates of obesity, cardiovascular disease and diabetes. Nutrition and food education can help contribute to public health policies for tackling diet-related disease (Tull, 2018) and inform health promotion and healthy eating initiatives. Given the role of food and nutrition in the health of people around the world and at all stages of the lifespan, a clear understanding of the fundamentals of good nutrition is needed. Arguably, the first concept that needs to be included in the school curriculum is the theory of energy balance, where energy intake, i.e. food and drinks consumed, is considered alongside energy expenditure, i.e. calories used for metabolic activities and physical exercise. Changes to this balance, such as greater energy intakes compared to energy expenditure, results in weight gain, and conversely, if energy intake is less than energy expenditure, then weight loss is expected. This energy balance equation is simple but also helps us understand how obesity may develop in the light of increasing food intakes and decreased levels of physical activity. However, more recently, researchers have suggested that the energy balance equation, whilst appearing straightforward, does not necessarily reflect the numerous factors that affect energy intake, such as hunger, social pressure, psychological factors, financial constraints and cultural influences, to name but a few (Hill, Wyatt, Reed, & Peters, 2003). Likewise, energy expenditure is influenced by physical activity, sedentary behaviours, dietary-induced thermogenesis (the increase in energy expenditure that occurs when food is consumed and metabolised) and even growth. Furthermore, this simplistic equation of energy balance does not explain how changes to one side of the equation may also impact the other side of the equation such that changes to energy intake may be accompanied by changes in the thermic effect of a meal or energy expenditures (Schoeller, 2009). Therefore, it has been suggested that the focus should be not just on what factors affect energy intake or energy expenditure but rather the gap between energy intake and energy expenditure.

As well as studying energy balance and the amount of calories required in the diet, the sources of those calories need to be considered, and this can include the energy-yielding macronutrients carbohydrate, protein and fat. Recent discussions in the media have focused on individual macronutrients and, in particular, differences between carbohydrate and fat, with some parties recommending low-fat and high-carbohydrate diets whilst others favour high-fat and low-carbohydrate diets, and this has led to much confusion (Mozzaffarian, Rosenberg, & Uauy, 2018). Knowing who and which sources to trust is particularly important in this area since there is much misinformation on the Internet and social media, often posted by those with vested interests. It is probably too simplistic to divide food into such basic categories since carbohydrates include wholegrains and fibres, as well as simple sugars, and fats include saturated, monounsaturated, polyunsaturated and trans fats (trans fats are mostly created artificially and are found in manufactured food (Skeaff & Mann, 2017)); furthermore, many foods contain a mixture of macronutrients. For this reason, it may be better to focus on food models rather than on individual macronutrients in the context of a balanced diet. Pupils need to understand not only the caloric and nutritional value of food but also how together they can contribute to a balanced diet.

The 'Eatwell Guide' depicts how to achieve a balanced diet; it was introduced in 2016 (Public Health England (PHE), 2016; see Fig. 15.1) and replaced the old 'Eatwell Plate'. The main changes in the 'Eatwell Guide' included the removal of the knife and fork because it was felt that they added little to the meaning of the model; the pictures of the food were drawn images rather than photographs; high fat, salt and sugar food were removed from the plate and were put outside the main image to help increase consumer understanding of the roles that these sorts of food and drinks play in the diet; fruit juices were removed from the fruit and vegetable segment; and some of the names of the segments were updated. The 'Eatwell Guide' now organises food into five main groups: (1) fruit and vegetables; (2) potatoes, bread, rice pasta and other starchy carbohydrates; (3) oils and spreads; (4) dairy and alternatives; and (5) beans, pulses, fish, eggs, meat and other proteins – recognising that there are foods other than meat that contribute to protein intake. There was also the addition of a hydration message, recommending that people drink 6–8 glasses of fluid every day, as well as details about energy requirements and the inclusion of a front of pack nutrition label. The 'Eatwell Guide' is said to apply to most people regardless of weight, dietary restrictions, preferences or ethnic origin. However, it is recognised to not apply to children under the age of two years who have different nutritional needs, and some people who may need to make adaptations based on their dietary requirements or medical needs.

Vitamins and minerals make crucial contributions to the diet and in most cases can be obtained easily if a variety of foods are consumed. It is worth informing pupils about the issues associated with too little of any nutrient but also the dangers of too much of any vitamin and mineral. If a varied diet is consumed, then typically there is no need for supplements; however there are some exceptions.

Women who are planning a pregnancy or who are pregnant should take daily a 400 mcg folic acid supplement up to the 12th week of pregnancy in order to prevent neural tube defects. Women who have a higher chance of having a pregnancy affected by neural tube defects need to take 5 mg of folic acid daily and should consult their GP (National Institute for Health and Care Excellence (NICE), 2018). However, not all pregnancies are planned, and women may be unaware that they need to be taking folic acid, so it has been suggested that flour should be fortified with folic acid. The UK government is currently launching a consultation on the amount of folic acid that should be added to help reduce the risk of complications (Department of Health and Social Care et al., 2019; Limb, 2018).

Other research has highlighted that some people need a vitamin D supplement to keep bones, teeth and muscles healthy. In spring and summer, most people get the vitamin D they need through sunlight on the skin and in the diet; however, in winter months, this may not be enough and a daily supplement should be considered (NHS, 2017). People who have little exposure to the sun should consider taking a supplement all year round (Scientific Advisory Committee on Nutrition (SACN), 2016). Children aged 1–4 years should also have up to 10 mcg daily of vitamin D, though children having more than 500 mL of infant formula milk a day will not need an additional supplement because the milk is already fortified with vitamin D.

Nutrition requirements do change during the lifespan, and it is important to understand how nutrition can help maintain good health at different stages since an individual's need for nutrients and energy changes over time and may be different for particular population groups (Langley-Evans, 2015). At any stage of the lifespan, there will be varying influences on nutritional status and food habits or constraints on dietary intake, including income, religion, vegetarianism, age, gender and lifestyle. Different factors will influence our nutritional intake from birth when breastfeeding is recommended, through weaning growth, adolescence, adulthood and ageing in the later years. Knowledge of the changes in nutritional requirements can ensure that appropriate advice is given.

Pupils should also be aware of the origins of food since evidence from the BNF shows that this is currently not the case (Ballam, 2017). An understanding of the fact that food comes from plants or animals and needs to be grown, farmed or caught is important and that food is changed as it makes the journey from farm to fork to make it safe and edible, for example the journey from wheat to flour to bread (Food a fact of life, 2018). Practical food growing not only can help teach pupils where food comes from but also reinforce teaching about healthy diet and create environmental awareness (Porritt, 2009). Food preservation and food safety also need to be considered to ensure that the food supply is safe, considers animal welfare and avoids the risk of food poisoning in the home and businesses.

Developing Areas of Research

Nutrition is an evolving science subject, and as such there have been major developments in the last decade. Recently, the gut microbiome has been identified as a key regulator of health and disease, and consequently there has been increased interest in the gut flora, otherwise known as the gut microbiome. The gut microbiome is the complex community of trillions of cells and microorganisms, including bacteria that live in our digestive tracts. The gut microbiota may be affected by diet, genetics, medication use, and stress (Lockyer, 2017). Intestinal microbes can influence absorption, metabolism and the storage of ingested nutrients and have important effects on the host's physiology (Gentile & Weir, 2018). For example, the microorganisms in the gut may be crucial for digestive function and play an important role in regulating the immune system, even appetite and energy metabolism (Valdes, Walter, & Spector, 2018). It would appear that we are only beginning to understand the role of the microbiome, as well as diet and host interactions (Mozzaffarian et al., 2018) and what food and supplements can help improve and maintain the microbiome. Probiotics are food and supplements that contain live bacteria, such as yoghurt or fermented food, and can now be bought from any supermarket. Probiotics are microorganisms that provide a health benefit to the host (Hill et al., 2014). The bacteria strains used vary widely, but well-studied and popular strains are from the genus *Lactobacillus*. There is some evidence that some probiotics can improve digestive health and may help prevent infections such as travellers' diarrhoea, but not everybody responds to probiotics in the same way, so further research is required to clarify the probiotics that will affect specific health outcomes and help identify the people who will respond positively to probiotics (Sanders, Merenstein, Merrifield, & Hutkins, 2018). Alternatively, prebiotics are non-digestible foods or food ingredients that can stimulate growth of bacterial species that are already in the gut. Research is working towards identifying particular prebiotics that can help improve and maintain a balanced gut microbiota to enhance health and well-being (Gibson, Probert, Van Loo, Rastall, & Roberfroid, 2004). We are only beginning to understand the way the gut may affect our brains, moods, hormones and metabolism, but it is apparent that a healthy varied diet that includes plenty of plant-based foods and fibre is important for a healthy microbiome.

Issues such as climate change, biodiversity, land use and soil condition all help shape the food system, as does access to clean water. The long-term consequences of food production, distribution and consumption all need to be considered to ensure that it is sustainable (Mason & Lang, 2017). The Food and Agricultural Organization (FAO) of the United Nations (FAO, 2010) have described sustainable diets as 'protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy while optimizing natural and human resources'. In their review of climate change and nutrition, Sustain (2013) concluded that benefits could come from reducing the amount of meat and dairy consumed and replacing it with food with lower greenhouse gas footprints; reducing intakes of sugary food, tea and coffee, and chocolate; reducing food waste and composting what food waste cannot be avoided, reducing the air freighting of food; avoiding bottled water; buying local, seasonal and fair trade products. The British Dietetic Association (2018) have also recently published a position statement on sustainable food where they highlighted that meat and dairy products are the leading contributors to greenhouse gas emissions and could be replaced with more plant-based proteins such as beans and pulses. They also commented that insects have been a much-discussed source of protein, but it may be some time before they are incorporated into many peoples' diet. Ultimately, though, solutions to global food issues will be dependent upon partnerships with governments and industrial corporations, as well as the will of individuals (Food & Agricultural Organisation, 2017).

Back in 2014, a group of nutrition scientists were asked to predict what the most important nutrition trends in 2020 would be (Hackman et al., 2014). Their list included the microbiome, global food security, energy metabolism, ageing, cancer, inflammation and bioengineering, but also nutrition education. They reported that nutrition education needed to identify methods to make healthy choices more appealing and encourage healthy behaviours. They also recognised the importance of social media platforms in disseminating nutrition messages. Social media can bring members of the public in direct contact with health experts, but there are plenty of opportunities for misinformation. Ensuring that nutrition information is accurate and evidence based will be a challenge now and in the future.

Conclusion

Clearly there is a need for investment in food and nutrition education to give pupils knowledge about healthy, safe and sustainable diet. New developments in nutrition research should inform the curriculum and help strengthen the teaching of food and nutrition in schools to give pupils the skills they need to make informed choices regarding food and diet that will protect their health and the health of their families in both the short and long terms.

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Chapter 16
A Curriculum Developer's Perspective on the Place of Food in the Secondary School in England

David Barlex

Abstract This chapter begins by considering the importance of food education in secondary schools in England in the context of the obesity crisis and the role of meat production in contributing to global warming. It continues with a discussion on how young people might be taught to cook and eat well. This is extended to a consideration of the role of science learning in meeting these objectives. Then the chapter discusses the possible content of secondary school food technology courses. Finally, there are concluding remarks which comment briefly on each of the previous sections in the light of possible curriculum development.

Keywords Curriculum development · Food education · Food science and technology · Healthy eating · Planetary stewardship

Introduction

This chapter will be in five parts. The first part will explore the importance of food education in England from the government's perspective. The second part will explore what young people might need to be taught in order to be able to cook for themselves (now) and for their families (in the future). The third part will explore the role of science understanding in learning how to cook. The fourth part will explore the possible content of food technology courses. The fifth part will consist of concluding remarks.

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The Importance of Food Education

The government in England has been exercised about the teaching of food in schools as part of its concern with regard to the nation's health and the impact of poor dietary choices on the cost of the National Health Service (NHS). 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).

These extracts from the summary of key messages (DIUS, 2007b) indicate the seriousness of the situation:

- In recent years, Britain has become a nation where overweight is the norm. The rate of increase in overweight and obesity, in children and adults, is striking. 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, coronary heart disease, cancer and arthritis. The NHS costs attributable to overweight and obesity are projected to double to £10 billion by 2050. The wider costs to society and business are estimated to reach £49.9 billion per year (at today's prices).
- The obesity epidemic cannot be prevented by individual action alone and demands a societal approach.
- Tackling obesity requires a far greater change than anything tried so far, and at multiple levels: personal, family, community and national.
- Preventing obesity is a societal challenge, similar to climate change. It requires a partnership between government, science, business and civil society.

Written over ten years ago this provides a stark warning, and now 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). Research has indicated that the number of fast-food outlets can double the chances of becoming obese (Briggs, 2014), and the UK's high streets currently have the highest concentration of fast-food outlets since 2010 (Homer, 2018). The following data from the Office for National Statistics are worrying:

- The UK has seen a 34% increase in fast-food outlets from 2010 to 2018.
- In 2010, the average number of fast-food outlets per 100,000 people was 47. It had risen to 61 by 2018.
- In nearly every area (204 out of 215), the rate of takeaways per 100,000 people was higher in 2018 than in 2010.

Hence, it is not difficult to see why the government wants young people to be able to eat well and do this by cooking for themselves. There have been several government interventions in the curriculum to achieve this in recent years.

In 2013, the government introduced a new National Curriculum, and within the design and technology programme of study, there was a section devoted to Cooking and Nutrition (Department for Education (DfE), 2013). For pupils aged 11–13, this reads as follows:

- Understand and apply the principles of nutrition and health.
- Cook a repertoire of predominantly savoury dishes so that they are able to feed themselves and others a healthy and varied diet.
- Become competent in a range of cooking techniques (for example, selecting and preparing ingredients; using utensils and electrical equipment; applying heat in different ways; using awareness of taste, texture and smell to decide how to season dishes and combine ingredients; adapting and using their own recipes).
- Understand the source, seasonality and characteristics of a broad range of ingredients.

The difficulty with this situation is that the time available to meet these requirements is limited, as the teaching would have to take place within the time allocated to design and technology.

In 2016, the government withdrew food as a material to be used within all design and technology specifications and replaced this with a new General Certificate of Education (GCSE) Food Preparation and Nutrition (DfE, 2015). The subject content is divided into four sections as follows:

- Nutrition
- Food
  - Food provenance
  - Food choice
- Cooking and food preparation
  - The scientific principles underlying the preparation and cooking of food
  - Preparation and cooking techniques: how and when the skills and techniques can be applied and how they relate to the knowledge and understanding requirement listed above
- Skills requirements: preparation and cooking techniques
  - This includes an extensive section on skills required to demonstrate and apply skills when planning, preparing, cooking and presenting a selection of recipes, modifying recipes or creating new recipes to meet particular requirements.

For all young people aged up to the age of 14 years the teaching of Cooking and Nutrition within design and technology is compulsory, but the Food Preparation and Nutrition GCSE course is an elective subject and the number of young people taking this is significantly lower.

Other Approaches to Health Eating

Whatever one may think about these actions, it is clear that they can be explained as part of the government's drive to improve the health of the nation and to reduce NHS costs. However, it is not just diet that contributes to well-being.

Physical activity also plays a key role, and in addition to influencing what we eat, the government promotes school sporting activities, which it sees as being linked to, and in synergy with, its Childhood Obesity Plan (Hinds, 2018). But there are mixed messages. The call for people to eat less meat in a bid to cut carbon emissions (Harrabin, 2018) led the climate minister Claire Perry to opine that it is not the government's job to advise people on a climate-friendly diet. Eating less meat, especially processed meat, would be beneficial health-wise (BBC news, 2018), so whilst it is appropriate to advise people on their diet with regard to avoiding obesity, it is not appropriate to give similar advice with regard to climate change.

This is at odds with the Foresight report (DIUS, 2007a) that indicated strongly that to be effective, government strategies required cross-ministry collaboration. At the time of writing, the Eat-Lancet Commission has published the report 'Food Planet Health Healthy Diets From Sustainable Food Systems' (Eat-Lancet Commission, 2019), which argues that the data concerning the impact of current food production and consumption are both sufficient and strong enough to warrant immediate actions. It identifies five strategies required to radically transform the food system, shown in Table 16.1. These strategies indicate that government attempts to promote healthy eating are justified, but in fact do not go far enough in that they do not consider the impact of food production on planet Earth and the need for a move to a much more plant-based diet. This has significant implications for the teaching of young people to cook and eat well – the topic under consideration in the next section.

Teaching Young People to Cook and Eat Well

An immediate question is where in the school curriculum might such teaching take place? We have already noted that the time available to teach cooking in design and technology lessons is limited. In a design and technology course for pupils aged 11–14, it is quite likely that the amount of time spent on food-related matters would be between 12 and 18 h in each of the three-year courses and that within this time a wide range of other matters would need to be considered. For example, the designing and making of food products, as opposed to simply following recipes; the nutritional content of food; the way food is produced, processed, distributed and sold; the impact of these processes on climate change; the competition between biofuel and food production for human consumption; and food hygiene. Given this wide-ranging agenda it might make sense to place teaching to cook in personal, social and health (PSHE) education, and to teach other aspects in other subjects such as science and geography. If one wants young people to design and make food products in design and technology, then the learning taking place in PSHE, science and geography would support this endeavour. Such cross-curricular learning would of course need to be coordinated in the secondary school if it was to be effective.

Young people do not have much control over the food they eat. Parents and carers usually buy and cook the food, and the food available at school is limited to that

Table 16.1 Strategies for transforming the food system on planet Earth

Strategy	Intention
Strategy 1 Seek international and national commitments to shift towards health diets	The scientific targets set out by this Commission provide guidance for the necessary shift, recommending increased consumption of plant-based foods – including fruits, vegetables, nuts, seeds and whole grains – while in many settings substantially limiting animal source foods. This concerted commitment can be achieved by making healthy foods more available, accessible and affordable in place of unhealthier alternatives, improving information and food marketing, investing in public health information and sustainability education, implementing food-based dietary guidelines, and using health care services to deliver dietary advice and interventions
Strategy 2 Reorient agricultural priorities from producing high quantities of food to producing healthy food	Agriculture and fisheries must not only produce enough calories to feed a growing global population but must also produce a diversity of foods that nurture human health and support environmental sustainability. Alongside dietary shifts, agricultural and marine policies must be reoriented toward a variety of nutritious foods that enhance biodiversity rather than aiming for increased volume of a few crops, much of which is now used for animal feed. Livestock production needs to be considered in specific contexts
Strategy 3 Sustainably intensify food production to increase high-quality output	The current global food system requires a new agricultural revolution that is based on sustainable intensification and driven by sustainability and system innovation. This would entail at least a 75% reduction of yield gaps on current cropland, radical improvements in fertilizer and water use efficiency, recycling of phosphorus, redistribution of global use of nitrogen and phosphorus, implementing climate mitigation options including changes in crop and feed management, and enhancing biodiversity within agricultural systems. In addition, to achieve negative emissions globally as per the Paris Agreement, the global food system must become a net carbon sink from 2040 and onward
Strategy 4 Strong and coordinated governance of land and oceans	This implies feeding humanity on existing agricultural land i.e. by implementing a zero-expansion policy of new agricultural land into natural ecosystems and species-rich forests, aiming management policies at restoring and reforesting degraded land, establishing international land use governance mechanisms, and adopting a "Half Earth" strategy for biodiversity conservation (i.e. conserve at least 80% of preindustrial species richness by protecting the remaining 50% of Earth as intact ecosystems). Moreover, there is a need to improve the management of the world's oceans to ensure that fisheries do not negatively impact ecosystems, fish stocks are utilized responsibly, and global aquaculture production is expanded sustainably
Strategy 5 At least halve food losses and waste, in line with UN sustainable development goals	Substantially reducing food losses at the production side and food waste at the consumption side is essential for the global food system to stay within a safe operating space. Both technological solutions applied along the food supply chain and implementation of public policies are required in order to achieve an overall 50% reduction in global food loss and waste as per the targets of the SDGs. Actions include improving post-harvest infrastructure, food transport, processing and packing, increasing collaboration along the supply chain, training and equipping producers, and educating consumers

Taken from 'Healthy Diets From Sustainable Food Systems' produced by the EAT-Lancet Commission provided by the school kitchen. Recent criticism of school meal provision in secondary schools has suggested that it does not support healthy eating behaviours (Jamie Oliver Food Foundation, 2017). So, one does wonder if teaching young people to cook in such an environment when they are aged 11–14 will pay much dividend when they are required to cook for themselves, i.e. when they move away from home which will probably not be until they are 18 years old or older. Some schools run short intensive programmes about learning to cook for their students as part of a sixth form programme preparing them for life at university (Lewis, personal communication, 2010).

However, given some schools in England are required to teach the National Curriculum, which includes teaching to cook, how might they decide what to teach? Several questions arise:

- What sort of facilities will young people have access to when they start cooking for themselves?

Most flats have a kitchen, which will be equipped with a cooker that features a grill, a hob (a surface with either hot plates or gas rings) and an oven. The kitchen may also to have a microwave oven. A fridge and freezer are likely to be available for a short- and long-term storage of perishable foods, and cupboards will be available for the storage of dry and tinned goods. A variety of pots, pans and cooking trays, plus cooking utensils, are also likely to be available, but limited to few sizes only. Any program in school to teach cooking must make some of these facilities available and teach how best to use them.

- What sorts of ingredients and food products will they have access to?

Most families in England live within easy travelling distance of large supermarkets, which sell a very wide range of food, drinks and food products. Young people cooking for themselves for the first time are likely to be on a low budget. Fruit and vegetables are available at low prices, as well as staples such as potatoes, rice and beans and bread and pasta. Eggs too are inexpensive. Fresh fish is relatively inexpensive, as is chicken and minced meat. Processed meat products such as bacon and sausages are inexpensive, although large consumption especially if fried is not healthy. With that range of ingredients it should be possible to create a varied, healthy diet at a low cost. It should be noted that this range may well need to be modified in attempts to move towards a more plant-based diet as recommended by the 'EAT-Lancet Commission'. However, within the walls of large supermarkets, there are large numbers of food products that require little in the way of cooking other than heating in a microwave oven, and these are generally high in fat, salt and sugar and are calorie intensive and inexpensive.

The availability of ingredients and ready meals at supermarkets also needs to be seen in the context of the advertising that is currently taking place to encourage people both young and old to 'just eat' (see for example https://www.just-eat.co.uk/explore/magicisreal and https://www.youtube.com/watch?v=dvRrh8NOTbM).

The message underlying these adverts is that time spent preparing your own food is time wasted when you could be doing other things. Thus, young people are encouraged to dial up fast food for home delivery so that they can get on with much more exciting activities. In the small town where I live, the 'Just Eat' website (https://www.just-eat.co.uk) identified 93 different restaurants from which I could order takeaway meals to be delivered to my door.

- *What sorts of meals should we be teaching them to cook*?

This might change in the light of a move to a more plant-based diet, but the following would seem to be appropriate in the light of healthy eating from a perspective that does not focus strongly on the environmental impact of meat production:

– Packed lunches – salads and sandwiches
– Simple quick-to-cook meals – baked potatoes plus fillings, pasta plus various sauces, rice dishes
– Simple fruit desserts
– Soups and stews

This list is a bit on the worthy side, and I wonder if I should include cakes and biscuits as possible tasty treats. Of course, the cooking methods should involve boiling, steaming and baking and should promote grilling as opposed to frying.

- *What are the influences that will shape their willingness and ability to cook for themselves*?

The food that is cooked and eaten at home by youngsters as they grow up will have a large influence on what they might cook when they leave home. The role of parents and carers in enabling their children to cook either by example of what they themselves do or through deliberately teaching them will be significant. There will be a cultural influence at play here both in terms of what is cooked and eaten (for example, Afro-Caribbean cuisine is different from Chinese cuisine, which in turn is different from Indian cuisine, and within these there may be regional or religious preferences) and whether there is a cultural tradition of home cooking. The availability of ready meals, takeaways, fast-food outlets and delivered meals will be a disincentive to cooking at home. One is left wondering whether learning to cook at school between the ages of 11 and 14 will influence young people to actually cook for themselves as they get older and leave home given the range of other influences.

Note that this development of a cooking programme of study is based on what would be useful for them when they have to fend for themselves once they have left home and what would likely be available to them in terms of ingredients and equipment. It has not been developed as a cookery course, and it should not be seen as preparation for an examination course. As to who would teach such a course, it would need to be taught by those who have the necessary expertise; for example, those who might already be teaching about food within D&T.

The Role of Science Understanding in Learning How to Cook and Eat Well

It is possible to teach young people a wide range of cooking skills that enable them to follow the instructions in recipes successfully but not necessarily understand why such recipes are successful, or the contribution they make to a healthy lifestyle. It is a scientific understanding of the principles of cooking and the role of ingredients within the cooking process and the nutritional properties of ingredients that is needed to overcome this limited skills agenda.

Farrimond (2017) has produced an interesting and comprehensive book, *The Science of Cooking*. It is organised into the cooking of different sorts of food: meat and poultry, fish and seafood, eggs and dairy, rice and other grains, pasta, vegetables and fruits, nuts and seeds, herbs and spices, oils and flavourings, and baking and sweet. Dorling Kindersley books are generally very visual and are laid out in a highly attractive manner; in short, they delight the eyes. The book is full of useful practical advice, and there is no shortage of technical information; scientific facts and explanations are also embedded throughout the book. It is a font of information but to my mind is overwhelming and does not present any 'Big Ideas' or key concepts that might be useful across the piece in making sense of the wealth of content presented.

Mary Myatt (2018) has written compellingly about the importance of 'Big Ideas' in achieving curriculum coherence and here we have an example of a publication that fails to take this into account. Given the limited time there is for any subject in the school curriculum, it is important to identify and teach such 'Big Ideas' or key concepts so that learners are in a strong position to make sense of the knowledge and skills they are expected to acquire. Below are some suggestions for these 'Big Ideas', but the author welcomes readers' views regarding their merits or otherwise and whether there are any other important omissions:

A. Big Ideas useful for understanding cooking:

- Particulate nature of matter: atoms, ions and molecules, including polymers
- Properties: all materials, including food, have properties according to their composition and the way the atoms, molecule or ions are arranged
- Property modification through the application of heat and a combination of other materials, including the formation of colloids and emulsions
- The difference between heat and temperature
- The role of heat transfer, via radiation, conduction and convection, in property modification
- Reversible and irreversible changes
- The composition of food in terms of fats, proteins and carbohydrates and the structure of these types of substances

B. Big Ideas for understanding healthy eating:

- The role of food in providing energy, in maintenance and repair of the body and in enabling growth

- The role of fats, proteins and carbohydrates in diet
- The energy provided by different foods
- The role of vitamins and minerals in diet
- Digestion, transportation and respiration: the breakdown of large molecules into smaller ones, their movement into the bloodstream and transportation into cells throughout the body where respiration takes place to provide energy
- The balance between the food eaten, the energy obtained from that food and the energy expended in exercise and maintaining body processes

For the teacher charged with teaching the skills needed to prepare the healthy food listed in the previous section relating this to the science Big Ideas will almost certainly be a challenge, particularly in respect to the time likely to be available. Collaboration with science and PE teachers will be required to ensure that these concepts have to some extent been taught in these subjects so the cookery teacher is not 'starting from scratch'. The cookery teacher can then build on this teaching in a way that helps learners appreciate the reasons for using particular ingredients, cook them in ways suggested by recipes and understanding how they contribute to healthy eating. Requiring the cookery teacher to teach the Big Ideas as well as the cookery will almost certainly lead to an overcrowded and rushed curriculum with the acquisition of skills, knowledge and understanding in the process. It is worth emphasising that there is a significant chemistry embedded in cooking, as exemplified by the inclusion of cookery in chemistry degree courses taught at Imperial College London through a Culinary Practice module (Samadder, 2019). Professor Alan Spivey, Assistant Provost (Learning and Teaching), said: 'The Chemical Kitchen will offer an amazing experience for all 1st year chemistry students at Imperial to kick-start their practical training in an unconventional and provocative way. Whether you want to be a chemist or a chef, skills such as meticulous planning and detailed observation and recording are vital. The plan is to encourage safe experimental practice, practical reproducibility and appreciation of the often overlooked parallels between the practice of chemistry and myriad other activities which require manual dexterity so as to inspire our students to excel as experimental scientists.'

The Possible Content of Food Technology Courses

Any possible content of a food technology course must reflect the nature of technology (a) to achieve intellectual coherence and (b) to avoid confusion with other food courses, for example, a food science course. De Vries (2007) suggests four ways of reflecting about the nature of technology:

- Technology as an artefact
- Technology as knowledge
- Technology as a process
- Technology as a property of humans

It may be unusual to view food and food products as technological artefacts, but this might be helpful in that we can separate food into two components: first, the composition of a particular food or food product and, second, the purpose of that food or food product, i.e. what it is in the food (its physical nature) and what it is for (its functional nature). Consider a birthday cake, made up from a list of ingredients (its physical nature) and its use as a food product to be eaten at a celebration (its functional nature). If we change its physical nature, we are almost certain to change its functional nature.

There is clearly a lot of technological knowledge in food technology, and there is an important difference between this and the scientific knowledge, which food technologists also use. Scientific knowledge is declarative, e.g. the calorific value of a set of ingredients can be measured and is a specific number of calories. This value is neither good nor bad; it just is. Whether these ingredients are 'good' for people who might eat them is a matter of judgement. This is normative knowledge and will depend on the effect that the ingredients have on those people. This will vary according to the lifestyles adopted by particular people.

Technology can be seen as a particular way of acting or doing things.

In general terms, this process may be seen to have three phases:

- Envisaging how things might be
- Envisaging what is needed to achieve this
- Creating this reality

It is not difficult to apply this process to food technology as follows:

- Envisaging how things might be – all people in a particular community are well fed.
- Envisaging what is needed to achieve this – the community identifies the types and amounts of food needed.
- Creating this reality – members of the community cooperate in growing, harvesting, storing and distributing the food.

Jacob Bronowski (1973) captures how technology is a unique property of humans in his seminal work *The Ascent of Man* as follows:

Man has a unique set of gifts which make him unique among animals … so that unlike them, he is not a figure of the landscape His imagination, his reason, his emotional subtlety and toughness make it possible for him not to accept the environment but to change it … (man has) the ability to visualize the future, to foresee what might happen and plan to anticipate it and represent to ourselves in images that we project and move around inside our head … Every animal leaves traces of what it was; man alone leave traces of what he has created (pp. 19, 20 and 42).

Through food technology humans have left significant traces of what they have created in that they have changed landscape as the result of agriculture, erected huge facilities for food storage, developed a host of ever more complicated machinery devoted to planting and harvesting and processing food, and devised a range of techno science devoted to increasing food production. Individual communities have, throughout history, devoted significant energy and resources to the task of feeding themselves, and now we are challenged with the task of using food technology to feed a growing and increasingly hungry world population. Naughton (in Banks, 1994) adds further weight to the idea of technology as a property of humans when he wrote that technology always involves 'ways of doing things … a complex interaction between people and social structures on the one hand and machines on the other' (p. 12).

We should not, however, let the difference between scientific knowledge and technological knowledge makes us to ignore the important relationship between science and technology. Arthur (2009) argues that technology can be viewed as the exploitation of phenomena revealed by science. He rejects a simplistic view that 'technology is applied science' but is adamant that it is from the discovery and understanding of phenomena that technologies spring. He notes that:

> It should be clear that technologies cannot exist without phenomena. But the reverse is not true. Phenomena purely in themselves have nothing to do with technology. They simply exist in our world (the physical ones at least) and we have no control over their form and existence. All we can do is use them where usable. Had our species been born into a universe with different phenomena we would have developed different technologies. And had we uncovered phenomena over historical times in a different sequence, we would have developed different technologies (p. 66).

Hence, in exploring the possible content of food technology courses, it will be important to acknowledge the scientific phenomenon on which the technology is predicated.

Considering Production

The narrative of food in the world starts with its production through agriculture and moves on to include its storage, processing, sales and distribution at individual, local, regional, national and global levels and ultimately its consumption. The production of some food on a global scale plays a significant role in global warming, and there is concern that the combination of rising population and the impact of climate change may significantly impair our ability to produce enough food to feed the world (Berners-Lee, 2019). There is competition between growing food for human consumption and producing biofuels (Nuffield Council on Bioethics, 2011). Some see the development of genetically modified foods as a solution to the world food problem and some see it as potentially harmful, whilst others object to the way it might be used to exploit farmers (Preston, 2018). A food technology course may focus on one or more parts of this narrative, and the associated issues and the depth of treatment would vary according to the ages of the learners. For the purposes of this chapter, I will consider only food production in some detail, but I hope to develop a more complete picture involving storage, processing, sales, distribution and consumption of food in a future publication. In considering production, I will try to be true to the nature of technology, identify the underlying Big Ideas, discuss appropriate pedagogy and consider the role that new and emerging technologies might play.

The most basic form of food production is subsistence farming by which a family or a community grows just enough food for them, with little amount to eat and a surplus if possible. Any disruption of this activity quickly leads to hunger and starvation. In 2015, about two billion people (slightly more than 25% of the world's population) in 500 million households living in rural areas of developing nations survived as 'smallholder' farmers, working on less than 2 ha (5 acres) of land (Rapsomanikis, 2015). A step up from subsistence farming is the production of sufficient food for own needs and a surplus which they can sell to others through local markets. A further increase in the scale of food production involves farmers producing food for sale only and using their earnings to buy food from other food producers or from shops and business that sell food. This sort of farming can feed into regional, national and global markets. This sort of farming can grow produce thatis sold into regional, national and global markets. The Food and Agriculture Organization of the United Nations (2009) predicts that the world population will reach over nine billion by 2050 from the current population of 7.4 billion. This will place a significant burden on food production. For example, the report estimates that by 2050, the net import of cereals of developing countries will more than double from 135 million metric tonnes in 2008/2009 to 300 million in 2050.

What experiences of food production might we wish young people to have? Is it unrealistic to expect young people to acquire the experience of growing and harvesting food for themselves? Perhaps schools that teach food technology should have one or more allotments on which young people can grow and harvest a variety of crops according to season. For the moment I am ruling out rearing and subsequently slaughtering livestock, although I could certainly make a case for keeping chickens and harvesting eggs and raising goats for milk, which could be used to produce cheese and yoghurt. There could be arrangements for some of their produce to be sold at a local market or a school shop. Some of the produce could be used in cooking lessons, and some could be further processed through preservation, e.g. jam or pickle making or in the case of wheat producing flour, which might be used for simple baking. This is in no sense a trivial endeavour. It would require funding, organisation and commitment, but its educational potential is high. The activities of planting, growing, tending and harvesting are underpinned by an understanding of the following Big Ideas concerning the needs of plants:

- Fertile soil to grow; for some soils, fertilisers might be needed.
- Appropriate weather conditions to supply sunlight and water at temperatures that do not harm the plants. In adverse conditions, additional water and protection from sunlight and cold might be required.
- Protective measures against pests and disease affect yields.

- Drainage to prevent the soil becoming waterlogged and preventing growth.
- Appropriate planting to maximise yields and enable harvesting.

None of these ideas are particularly difficult to understand, but unless each is considered in the teaching and the way the allotment is managed then the learning achieved by the young people will be limited. It is worth noting that this experience can be seen in the light of the four ways of thinking about technology suggested by Marc de Vries (2007). They are technology as an artefact – the use of tools, materials and equipment to plant, grow and harvest food as well as to produce food; technology as knowledge – the application of Big Ideas to grow and harvest food; technology as a process – the entire activity of planting, growing and harvesting can be seen in this light; and technology as a property of humans – the entire endeavour can be seen as a technological activity carried out by humans. Hence, this learning activity is true to the nature of technology.

The learning associated with school-based food production can act as a springboard for considering food production in the world outside the confines of the school allotment with particular reference to the way technologies, particularly new and emerging technologies, are being utilised. Consider vertical farming (as opposed to the horizontal farming used in the school allotment). According to some, this innovation is set to revolutionise food production (see (http://www.bbc.com/future/story/20170405-how-vertical-farming-reinvents-agriculture) and https://vertical-farming.net/), but others argue that it can only be successful if it meets a range of stringent criteria (see, for example, https://university.upstartfarmers.com/blog/9-reasons-why-vertical-farms-fail).

The cultivation of leafy greens, easily carried out in the school allotment, is the focus of a vertical farming initiative (see https://aerofarms.com). The key technologies are summarised in Table 16.2. It would be instructive for young people to compare the way the needs of plants were met when growing and harvesting food on the allotment with the way these needs were met in the vertical farming approach. Such a comparison would provide insight into the way food technology is developing by embracing new and emerging technologies.

Despite the concern that has been raised as to the impact of automation on the way people might be able to work in the future (Carr, 2015) in many areas of farming, automation is seen as a boon as it enables large amounts of work to be done with little human labour and, in some cases, is required because human labour is not available. The use of driverless tractors to help harvest wheat is already available (see https://agfax.com/2018/11/26/driverless-tractors-are-closer-than-you-think-dtn/). Machines that can autonomously seed and weed are already available (see https://www.machinedesign.com/motion-control/farm-robotics-are-taking-giant-automated-leap-forward). And in response to shortages in farm labour, a variety of autonomous fruit-picking machines are being developed (see https://www.cnbc.com/2018/03/08/wave-of-agriculture-robotics-holds-potential-to-ease-farm-labor-crunch.html).

Table 16.2 Technologies for the vertical farming of leafy greens developed by Aerofarms®

Smart aeroponics	Aeroponics is used to mist the roots of greens with nutrients, water and oxygen. The aeroponic system is a closed loop system using 95% less water than field farming and 40% less than hydroponics.
Smart light	LED lights are used to create a specific light recipe for each plant, giving the greens exactly the spectrum, intensity and frequency they need for photosynthesis in the most energy-efficient way possible. This engineered lighting allows control of size, shape, texture, colour, flavour, and nutrition with razor-sharp precision and increased productivity.
Smart nutrition	Constant monitoring all of the macro- and micronutrients for our plants to provide them with everything that they need to thrive. Taking the exact same seed from the field and it grows in half the time as a traditional field farmer, leading to 390 times more productivity per square foot than a commercial field farm.
Smart data	Some 130,000 data points are monitored every harvest, constantly reviewing, testing and improving the growing system using predictive analytics to create a superior and consistent result. With remote monitoring and controls in place, the typical risks associated with traditional agriculture are minimised.
Smart substrate	A patented, reusable cloth medium is used for seeding, germinating, growing, and harvesting. The growing cloth medium is made out of BPA-free, post-consumer recycled plastic, each taking 350 (16.9 oz) water bottles out of the waste stream. The cloth can be fully sanitized after harvest and reseeded with no risk of contamination, acting as a barrier between the mist and the plants.
Smart pest management	Every aspect of our growing process has been optimized to minimize and mitigate pest proliferation. In addition to our controlled, indoor environment, our growing methods disrupt the normal life cycle of common indoor pests so that they never get started.
Smart scaling	The size and configuration of the system are highly customizable. The systems are comprised of modules that serve as building blocks that can be stacked vertically or lengthwise. This allows us to grow in varied locations and achieve ultimate yield per square foot, no matter the space, with quick installation.

And now drones (unmanned aerial vehicles) with sensors are being applied to farming in order to help increase crop production and monitor crop growth. Sensors and digital imaging capabilities can give farmers a richer picture of their fields. This information may prove useful in improving crop yields and farm efficiency. The report 'Drones for Agriculture' (Sylvester, 2018) from the Food and Agriculture Organization of the United Nations provides a wide-ranging and up-to-date set of case studies indicating the increasing significance of this technology in agriculture.

In short, food production is becoming 'smart', and such methods are on the increase. Hence, this should surely feature in a food technology course alongside an understanding of the traditional methods of farming and how these are being adapted in this light. The depth and extent of treatment would depend on the age of the learners.

Concluding Remarks

What are we to make of this curriculum developer's perspective? There can be little doubt that the government in England sees education in food as important at least through the lens of healthy eating and cooking healthy meals in response to the obesity crisis facing the nation. Whether the interventions in terms of a revised National Curriculum and the new GCSE qualification in Food Preparation and Nutrition will have the desired effect is still open to question. Time will tell. Teaching young people to cook and eat well is, like many initially appealing ideas, not as simple as it seems.

The curriculum is crowded, and there are other aspects of food education to be considered. This has jeopardised attempts to teach all young people to cook. I have suggested that such teaching might take place as a separate part of the curriculum unencumbered by other aspects of food education. Clearly this has risks. Would it have the necessary status or resources, for example? Would such an approach be possible? Would it be successful? Also, many of the factors that influence young people with regard to their ability and willingness to cook for themselves are outside the control of schools. It is clear that science understanding has a role to play in learning how to cook and eat well, but such understanding is not achieved through teaching cooking skills alone. Collaboration between those teaching cookery and those teaching science will be important here if young people are not to get mixed and confusing messages.

A discussion between science and food colleagues about the Big Ideas identified above and how best they can be utilised in teaching young people how to cook and eat well might be a useful starting point. In 2016, the government in England removed the A level qualification in Food Technology and with it the opportunity for young people aged 16–18 years to continue an academic study of food. The new qualification in Food Preparation and Nutrition for young people aged 14–16 resulted in the removal of food as a material to be considered in Design and Technology. The place of food within the Design and Technology National Curriculum (for young people aged 11–14) places high emphasis on Cooking and Nutrition alongside the opportunities for some food product development. Where do these experiences and the lack of opportunity 16–18 put the study of food technology for young people?

My consideration of the possible content of food technology is admittedly a very curtailed discussion, but I think it indicates that there is very little in the way of food technology as such being taught to young people aged 11–18. Devising a food technology course that the government might consider worthwhile as an A level will be challenging and needs to involve a range of stakeholders: school teachers, university lecturers and food and farm industry representatives, awarding organisations, professional associations and learned institutions. I hope that my discussion of the possible content of food technology courses goes some way to showing that such a course would be interesting, worthwhile and useful and that the effort required from the stakeholders to achieve this would not be a waste of time.

Developing a set of food technology courses for young people aged 11–18 would require buy-in from key stakeholders, in particular the learners and senior leadership teams (SLTs) in schools. The justification for such courses, given the importance of food in the world across a range of interrelated and significant issues such as health, combating global warming and feeding a growing population, gives the courses both relevance and urgency, and one would hope that SLTs would see them as an important if not essential component of general education for all young people up to the age of 16, if not beyond. In terms of learner buy-in, there is always a pedagogical challenge in dealing with content that is conceptually demanding and perhaps not what they are used to learning about. This is not insurmountable but does rely on teachers developing approaches that are appealing to learners. The argument that dealing with matters that are not immediately to the taste of learners because they are 'beyond their ken' is weak in that it denies learners the opportunity to expand their horizons.

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Chapter 17
Population Growth and Global Food Supplies

Christopher Ritson

Abstract Nineteenth-century classical economist Thomas Malthus predicted a bleak future for mankind because of his argument that population growth had a natural tendency to outpace growth in food supplies. Interest in the ideas of Malthus was reawakened by the explosion in international food prices during the 1970s—the 'World Food Crisis'—but this quickly subsided when prices fell and we entered an era of 'cheap food'. However, international food prices exploded again in 2008 and since then have remained relatively high and volatile. This time, the cause may have been a major shift in the long term balance between supply and demand for food on world markets. Although most experts predict a gradual decline in the rate of growth in the world's population, this still means many more mouths to feed by the end of the century. In principle, there can be enough food, but more enlightened international policies will be required if global inequality does not lead to a Malthusian future.

Keywords Food prices · Global population growth · Thomas Malthus · World food supplies

Introduction

The term 'Globalisation' has become popular to refer to how we now live in an interdependent and interconnected world, with massively increased trade and cultural exchange. Aspects of our food – what we eat, where it comes from, how it is prepared, its variety, the manner and occasion for consumption – are all part of this. Most people will know that their diets now typically involve a vast range of food and food ingredients sourced both locally and globally, and they will be aware that distant supply problems can lead to foods they usually buy becoming unavailable, at least at a price they can afford. What is not widely recognised, though, is how events on a global scale have the potential radically to alter the price and availability

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of all food that people now consume, irrespective of whether sourced locally or globally. That is the issue addressed by this chapter.

Thomas Malthus

In 1798, a book was published anonymously with the title 'An Essay on the Principle of Population'. The author was English political economist Reverend Thomas Malthus. He 'came out' in the second edition of 1803 and gave the book the much longer convoluted title 'Essay on the Principles of Population, or a View of Its Past and Present Effects on Human Happiness, With an Enquiry Into our Prospects Respecting the Future Removal or Mitigation of the Evils Which It Occasions'. This, however, captures rather well his dismal – indeed 'Malthusian' – vision of the future of mankind. The central proposition put forward by Malthus was as follows:

> Population, when unchecked, increases in a geometric ratio. Subsistence [food production] increases in an arithmetic ratio. A slight acquaintance with numbers will show the immensity of the first power in comparison of the second (Malthus, 1803, p. 8).

It is not difficult to appreciate why Malthus believed that the population would increase geometrically. A geometric progression is one in which each number is a multiple (called the common ratio) of the previous one. So, for example, if each married couple has on average four children who live to adulthood (far from uncommon in Malthus's time), two become four, four become eight, eight become 16 and so on. In this case, the common ratio is two, but any value over one will produce a curved line, such as that illustrating growth in population in the left panel of Fig. 17.1.

At no point does Malthus explain why he believed that food production could increase only arithmetically, but a little thought suggests that he regarded this as

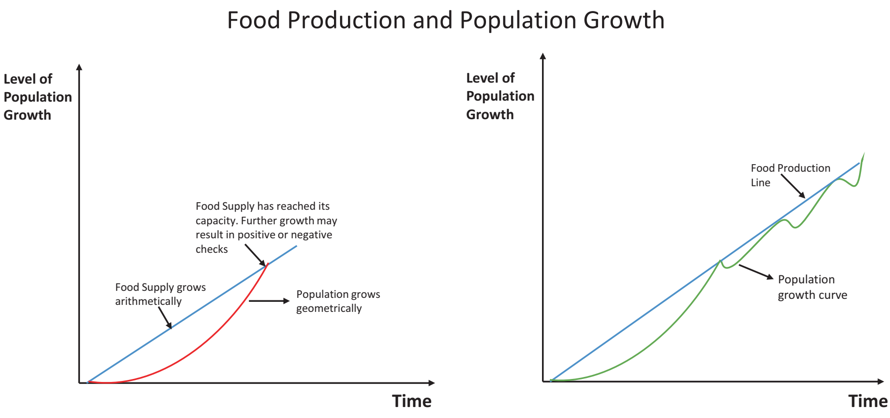

Fig. 17.1 Growth in population and food production according to Malthus

self-evident. An arithmetic progression is one in which the interval between each number remains constant – for example, 1, 2, 3, 4 or 2, 4, 6, 8 etc. In Malthus's day, the main way that more food was produced was to increase the cultivated area. Indeed, one commentator has claimed:

> From the beginning of agriculture until the mid-twentieth century, growth in the world grain harvest came almost entirely from expanding the cultivated area (Brown, 2012, p. 72).

This is something of an exaggeration. During the 'Agricultural Revolution' of the seventeenth and eighteenth centuries, wheat yields in Western Europe more than doubled, mainly due to the introduction of crop rotation systems. Nevertheless, from Malthus's day to around 1950, average annual wheat yields in England remained virtually unchanged at a little over 2 tons a hectare.

Food production increasing arithmetically is depicted by the straight lines in Fig. 17.1, and of course the outcome is that the curved line will eventually overtake the straight one. What happens then? In the Malthusian world, it is population that adjusts by what he called 'positive checks' (premature death, disease, starvation, war and so on). An alternative was 'preventive checks' (moral restraint, delayed marriage), but Malthus was not confident that this could be achieved. Population therefore bounces against the constraint of food production, as shown in the right panel.

After Malthus

Figure 17.2 shows how the world's population has grown from the estimate of 0.9 billion, when Malthus was writing, to today's level of approximately 7.5 billion. It is evident that Malthus was correct in predicting that population would grow geometrically, though the rate of growth does not really take off until well into the twentieth century. The rate of growth peaks around 1965 at about 2% per annum and has then declined to nearer 1% today. Most experts predict that the rate of growth will continue to decline, with the world's population peaking around 2100 at a little over 11 billion.

During the nineteenth century, and well into the twentieth, food production continued to expand but mainly on account of new lands in America and Australasia being opened up for cultivation. Food availability does not appear to have acted as a major constraint over population growth. There have of course been plenty of wars, disease and famines, but it is questionable as to whether the capacity to increase food production was the major cause of these population growth checks, In particular, in a groundbreaking study, an Indian economist, who worked at the London School of Economics, wrote a book (Sen, 1981) that revolutionised thinking on the causes of famine. Previously it was seen as a fairly simply issue of food production and supply shortage. What Sen argued, following a detailed study of the Bengal famine of 1943, was that famines were not always, or even not usually, caused by supply shortage but by lack of access to food (which he called Entitlement)

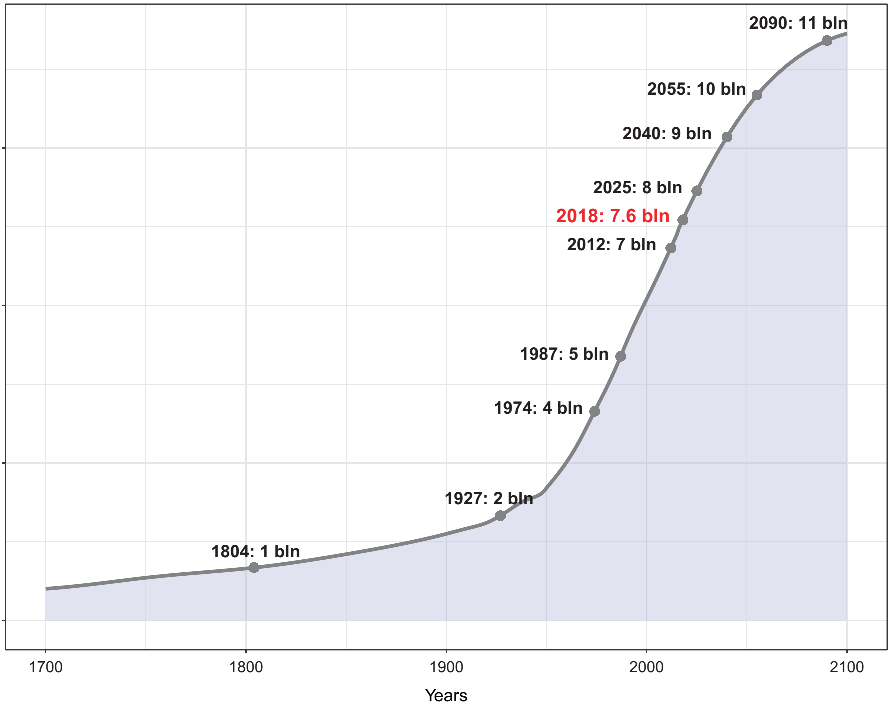

Fig. 17.2 World population. Source: Constructed using UN Population Database

for sections of the population, for a whole range of reasons but principally poverty. One academic has commented:

> The most valuable contribution of the entitlement approach to famine theorising is that it shifts the analytical focus away from a fixation on food supplies – the Malthusian logic of 'too many people, too little food' – and on to the ability of groups of people to acquire food (Devereux, 2001).

In the middle of the twentieth century, when the growth of the world's population began to accelerate, so did food production, but this time it was yields rather than area cultivated that increased, and they did so at an astonishing pace. To give just a few examples, between 1950 and 2000, yields of wheat in England, which had been steady for over 100 years, rose from a little over 2 tons per hectare to 8 tons; French sugar beet yields rose from 3 tons per hector to nearly 12 tons, and potato yields from 120 tons per hectare to 400 tons; and in both countries, milk yields went from just over 200 kg per head per year to nearly 700 kg. In the developing world, the so-called green revolution also led to substantial increases in wheat and rice yields.

World population and agricultural productivity both taking off in the middle of the twentieth century is of course no coincidence, though as food production does not appear previously to have acted as a Malthusian constraint on population growth, the link is most likely to have been population growth being the driver for increased agricultural productivity. Many writers, in particular Ester Boserup (1981), have argued that population growth acts as a spur to innovation in food production. Between 1950 and 2000, it is estimated that well over 90% of increased world cereal production came from higher yields rather than increased cultivated area – there was by now of course very limited scope for finding extra land to cultivate.

But it was not just increased production that led to more food for human consumption. In 1950, more than half of the UK cereal crop went to feed animals. An additional source therefore came from tractor power replacing horses. Fossil fuels replaced animal feed, allowing more of the cultivated area to be devoted to the production of food for human consumption. And fossil fuels, via the production of nitrogen fertiliser, together with improved plant-breeding techniques, were also the main source of the growth in yields. So the Malthusian vision of the future of mankind did not materialise. There were two scares, though.

The First World Food Crisis

Although today we typically view Malthus's proposition in a global context, it is probable that he thought of it as applying at the level of the nation state, the balance between a country's population growth and that country's food production, with potential famine localised to that country. However, during the first half of the twentieth century, the two World Wars saw food shortage on an international scale. In both cases, prices of food commodities traded internationally rose to unprecedented levels. For a food-importing country (such as the UK), security in food supplies was associated with international conflict. This all changed in the mid-1970s.

Figure 17.3 shows the United Nations Food and Agriculture Organization (FAO) food price index in real and money terms from 1960 to 2018. (Real means that an

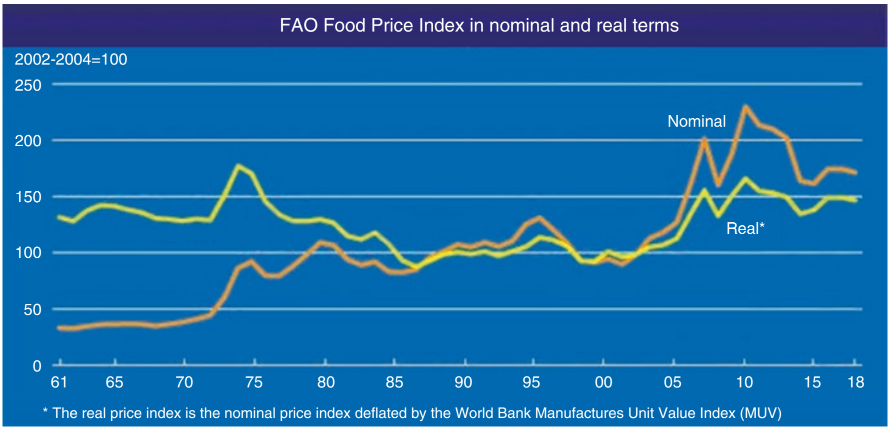

Fig. 17.3 FAO food price index. Source: FAO (2018) World Food Situation http://www.fao.org/worldfoodsituation/page-storage/foodpricesindex/en/. Reproduced with permission

attempt has been made to remove general inflation from the data.) The index is based on the internationally traded prices of basic food commodities – cereals, dairy products, meat, oilseeds and sugar. After the shortages of the Second World War, food supplies quickly recovered, and during the 1950s and 1960s international food commodity prices declined in real terms, aided by the onset of improving yields referred to above. The 1970s was different. First, there was a sudden rise in dairy product prices, caused by the coincidence of dry Northern and Southern Hemisphere summers. In 1973, there was the explosion of international oil prices, and for reasons that are not well understood, there appears to be a strong link between oil and food commodity prices. But the most interesting event was the failure of the Russian grain harvest. Malthus would have expected this to result in famine in Russia, but this time, showing exceptionally clever market behaviour, the USSR purchased, at rock bottom prices, virtually the entire USA grain reserve – an event subsequently labelled 'The Great Grain Robbery' (Morgan 1979), and this resulted in an explosion of international grain prices (and also the price of grain fed livestock). The failure of the Russian (and Ukraine, then part of the Soviet Union) harvests had been internationalised – the globalisation of the food economy had arrived.

Some low-income countries had become dependent on cheap imports of (mainly) USA grain, and their food supplies were badly affected. But globalisation also meant that rising international prices pulled up the price of domestically produced produce. In the European Economic Community (EEC), where the Common Agricultural Policy had been taxing imports and subsidising exports of grain to support internal market prices, exports were now taxed in an attempt to prevent internal prices rising with international prices.

This all happened shortly after the publication of 'The Limits to Growth' (Meadows, Meadows, Randers, & Behrens, 1972), which was the first major study drawing attention to the potential cataclysmic outcomes of continued population growth in the face of the limits to the earth's resources. This, together with what was now being described as 'The World Food Crisis', led to a reawakening in interest in Malthusian ideas. However, as can be seen in Fig. 17.3, world food prices came down as fast as they had gone up, and the world entered a 30-year period, which I have described elsewhere (Ritson, 2016) as 'The Era of Cheap Food'.

The Second World Food Crisis

Around 2005, international food commodity prices started to firm, then towards the end of 2007 exploded to quickly reach (in real terms) the levels of the mid-1970s. However, two years later, they had fallen substantially, and most commentators argued that we were simply experiencing a rerun of the 1970s. The rise in food commodity prices had again been preceded by much higher oil prices, and this was of course also the onset of the financial crisis – perhaps food price inflation was simply a symptom of the financial crisis?

However, 2010 saw a second explosion, followed by a sustained period of relatively high and extremely volatile world food prices. In 2018, the average price of internationally traded food commodities was still 50% higher in real terms than prior to 2007. This does not mean that food prices in shops are 50% higher, but it does mean that the companies that supply and process our food are paying 50% more for their raw material, irrespective of whether imported or domestically supplied. Perhaps it is different this time and the era of cheap food is over?

At this point, we need to pause and question why food prices are so susceptible to extreme volatility. This is really quite straightforward. In terms of quantity consumed (however measured), people are understandably reluctant to cut down in the face of rising prices and tend to continue to buy the same quantities, until very high prices force change. Similarly, low prices do not induce people to eat a lot more. So small supply shocks (bad harvests, for example) can cause prices to explode – a 10% reduction in supply can easily result in prices doubling, and this now appears to be happening on a global scale rather than being localised.

The second reason why food commodity prices are so volatile is that, with most agricultural production, it takes *time* for production to respond to high prices. However, there is a saying that 'the best cure for high prices is high prices' – so once enough time has passed, food prices can come down as rapidly as they went up. This is clearly what happened in the 1970s – so why has it been so different this time?

There is a mistaken belief that food price volatility will always have been caused by short-term supply shocks, whereas longer term developments in the overall balance between supply and demand will only be associated with relatively smooth, longer term trends in prices. This is probably correct when the growth in supply is tending to outpace the growth in demand, as seems to have been the case during the 'era of cheap food'. Governments in Western countries were willing to allow stocks to accumulate and to introduce measures to restrict production (such as milk quotas and land retirement under the Common Agricultural Policy), helping to moderate the pace of the decline in international prices.

However, what would happen if this picture was reversed and the longer term growth in demand on a global scale begins to outpace the growth in supplies? At first, a net reduction in stocks from one harvest year to the next may be able to offset the shortfall in supply versus demand, but once that is no longer possible, prices are likely to explode in just the same way as with a temporary supply shock. Whereas it is always possible to accumulate stocks, once they are depleted, it is not possible to increase supplies until production can be increased. If the growth in demand continues to tend to outpace the growth in supply, prices will continue to be volatile around a much higher level rather than quickly decline, which happens if the price explosion has been caused by a short-term supply shock. Understanding the causes of our recent experience of volatile world food prices is therefore critical in any attempt to foresee the future development of world food prices.

A Shift in the Factors Underlying Global Demand and Supply of Food

Following the explosion of food prices in 2008, commentators gradually became aware of three major changes in the factors underlying demand and supply, which seemed to have developed since the turn of the century: one affected supply and the other two demand.

First, there has been a substantial slowdown and, in some cases a complete standstill, in the growth in yields mentioned earlier. For example, from 2 tons per hectare in 1950, UK wheat yields reached 8 tons in 1995. Twenty years later, they were still at 8 tons. A similar slowdown in the growth in crop yields has been identified for cereals in Western Europe and North America and rice yields in the Far East.

Because yields fluctuate so much from year to year, it was some time before this radical (and worrying) change became apparent. There is considerable uncertainty over the cause, but two possible explanations predominate. The first is economic. The sustained period of low (and declining) prices discouraged investment in new technologies, particularly in the case of plant breeding. The second is biological – that irrespective of human ingenuity in technological innovation, there is a limit to the extent to which improved yields can be achieved.

The second factor was the appearance of a major new source of demand for crops – the production of biofuel. Driven by the search for 'greener' sources of energy (and in the US by a drive to rely less on imported fuel) and stimulated by the relative low prices of the raw material, within a matter of a few years, a substantial amount of land became devoted to energy crops rather than food production. In the US by 2010, more than half of the corn (maize) crop had been diverted to biofuel. This represents an intriguing reversal of one of the factors that has been contributing to the growth in food production since World War II, when fossil fuel replaced animal feed to provide power on farms. Now crops are once again providing power, but this time by the production of biofuel rather than by feeding horses.

The third factor influencing the overall global balance between food supply and demand concerns changing dietary choice, mainly in Eastern Asia. It has long been recognised that as a country experiences economic development and incomes rise, people spend a decreasing proportion of their income on food. At the same time, their diets evolve and, in particular, tend to incorporate an increasing proportion of (more expensive) animal rather than vegetable protein. So demand for animal products tends to increase relative to the demand for vegetable products. However, historically, animals destined for human consumption did not compete directly with food crops – much of the animal population was grass fed – or with pigs and poultry by various scrap/waste products. This has changed with the development of intensive livestock systems, with animals being fed principally on grain supplemented by (usually soya) protein. It requires something like four times the amount of grain and pulses to provide people with the same food value if they consume them via animals rather than directly as vegetable products. Rapidly rising personal incomes in Asia has led to a major switch in diet towards animal products and thus a vastly increased demand for grain and pulses compared to what would be required if people had stuck to mainly vegetable-based diet.

The rise in personal incomes, and with it the increasing demand for intensive livestock products in East Asia, has coincided with the period leading up to and during the recent explosion in world food prices. From virtually nothing at the turn of the millennium, China's imports of soya had reached 60 million tons by 2013 and maize 20 million tons by 2015.

Malthus Revisited

There is therefore considerable evidence to suggest that the recent volatility, and historically high level, of the price of internationally traded food commodities has been caused by a major shift in the overall balance between the growth in demand and supply of food commodities on a global scale. Does this mean that Malthus may now be vindicated? In the Malthus version, the growth in demand for food, overtaking supply, comes solely from population growth, and this can only be resolved by 'positive checks' on population growth, induced by food shortage. Figure 17.2 shows the rate of global population growth declining to zero by 2100, but that still involves an increase from today's world population of 50% – four billion more people. Can they be fed? Or are we to experience Malthus's 'positive checks'?

The somewhat reassuring feature of the above explanation for recent food price volatility is that it is not population growth in itself that is suggested as driving an increase in the rate of growth of global demand for grain but two new factors adding to the impact of population growth, and in principle, both are reversible. All the land devoted to crops for biofuel could revert to crops for food, and people could revert to more vegetable-based diet.

This raises two questions. Are these reversals likely to happen, and if so, what are the mechanisms that would cause it to happen? High grain prices have already led to some curtailment in the production of biofuel, and in Europe it is legislation requiring the incorporation of biofuel which is sustaining demand, with the raw material price now too high to sustain production. Thus, government policies towards green energy are likely to be the main influence here.

Similarly, high feed prices mean high meat prices, and consumers may therefore be induced to revert to more vegetable-based diet. The danger is that income inequality in many parts of the world could mean this being paralleled with not enough food for many people. So here, also government and international policies would need to accompany high prices to avert famine. In this case, the 'Ethical Consumer' becomes important, with an upsurge of interest in, and support for, 'sustainable consumption' behaviour in Western countries, with 'eat less meat' being a major component of this.

Finally, is there any prospect of a resurgence in yield growth, stimulated by the rewards of higher crop prices, together with public concern over food security leading to more government funding for new technologies in food production? The most prominent new technology is of course genetic modification and what appears to be its more ethically acceptable recent version, 'Gene Editing' (which does not involve transfer of genes between species). These techniques could contribute to feeding the growing world population by inducing traits such as pest, drought and salt tolerance. Other new technologies, such as for example synthetic biology (meat cultured in the laboratory) or 'Tower Farms', could also be described as yield increasing as only small areas of land may be required. However, these are less promising because they become viable (for now anyway) only for very-high-value food products. Other approaches, such as nano-technology, have so far only been proposed as methods of improving quality characteristics rather than innovations that contribute to the totality of food produced. Perhaps the development with the most potential for combatting the impact of growth in the consumption of grain-fed livestock is the farming of insects, which involves far superior protein feed conversion rates.

Conclusion

There is substantial evidence to suggest that recent experience of higher and more volatile international food prices has been caused by a change in the long-term balance between food supply and demand globally. Food is likely to remain relatively more expensive than it was 15 years ago, and international prices of food commodities are likely to continue to be volatile. With the world's population expected to grow by some 40% by the end of the century, a major global challenge confronts the world, if Malthusian 'positive checks' are to be avoided.

However, in principle, many of the causes of this imbalance between increase in demand and growth in supply of food are reversible. Thus, with changing patterns of consumption (less meat, less waste, less biofuel), together with new yield-increasing technologies, there can certainly be enough food globally to feed the world's population adequately throughout the twenty-first century. In part, higher prices may stimulate such a reversal, and belief in the merits of sustainable consumption may also contribute. But most important is probably the need for the political will to ensure that global inequality does not lead to a Malthusian future.

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Chapter 18
Socially Acute Questions: How Biotechnology Can Provide Context and Content for Discussion in Food Technology Education

Bev France

Abstract Biotechnology provides a rich source of socially acute questions that can be asked when considering the risks, moral issues and legitimacy of biotechnological food being labelled 'pure' and 'natural'. This chapter explores some of the issues encountered when considering the issue of genetically engineered food as a socially acute question (SAQ). These include the low level of public support for genetically engineered food, especially when the public believes that they have no control over consumption. The level of acceptance is affected by a person's view of the riskiness of the food, as well as the moral and ethical issues in its production and consumption. Consequently, the dimensions of risk, as well as how it is perceived, are explored in terms of food education. A range of pedagogical strategies are described that enable students to discuss these issues from a broader perspective than just the technological criterium of 'fit for purpose'. These include a 'Futures Toolkit' that can identify if a SAQ is 'hot' and could involve direct action or one that is 'cooler' where an indirect response activity is appropriate. A range of strategies are described that help students not only identify their viewpoints but also provide space to explore others' views.

Keywords Socially acute questions · Genetic engineering · Food technology
Communicative pedagogies

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Introduction

The biotechnology industry inspires diverse reactions from the public, especially when ethical and social issues are under consideration. Even though the majority of the public are optimistic that biotechnological innovations have the potential to improve our quality of life in the European Union, there is low public support for genetically modified food in comparison to an overall positive attitude to science, technology and biotechnological processes (Rigaud, 2008). It appears that biotechnology and, in particular, genetic engineering provide rich contexts to identify controversial issues not only from a personal and emotional perspective when consumer issues of food labelling of 'organic', 'pure' and 'natural' are identified but also when broader issues such as how food quality and food safety can be maintained and enhanced to optimise health and reduce disease are given focus (Floros et al., 2010). Consequently, because biotechnology employs genetic engineering (GE)[1] as an underpinning framework for new and improved food, the acknowledgement of the technology augments the controversy and can provide a rich source of controversial issues when exploring the pedagogical potential of socially acute questions (SAQs) when related to food production.

What Are Socially Acute Questions (SAQs)?

Socially acute questions (SAQs) are 'open ended questions that involve ill-structured problems that integrate knowledge in the humanities and sciences and are complex and raise uncertainties' (Simonneaux, Panissal, & Brossais, 2013, p. 2379). They are distinguished from socio-scientific issues (Zeidler and Nichols, 2009) in that SAQs involve issues that are not just confined to scientific contexts where science is 'sacralised' by the view that science is the 'best' way to provide truth and impart power to act on reality. Instead, this broader perspective of exploring socially acute questions allows consideration to be given to SAQs that range further than established science, technology, engineering and mathematics (STEM) education discussion to consider the influence of civics, politics and the historical impact on people's views about such issues.

Instead of examining controversial issues from a narrow science perspective where science is given dominance and there is the assumption that scientific answers will be applied in solving technological and social problems, there is a push to open the discussion to many more disciplines. Consequently, socially acute questions provide a broader framework for defining and giving focus to a discussion about controversial issues such as those concerned with food, biotechnology and genetic engineering.

[1] GE (genetic engineering) or genetic modification (GM) is the introduction of new traits to an organism by making changes directly to its genetic makeup https://cban.ca/gmos/faq/gmge-definition/ (Canadian Biotechnology Action Network, 2019).

The Role of Genetic Education and Biotechnology in Food Production

Biotechnology has a long history in food production and occurs when living organisms and their subcellular components are utilised to develop products and processes (Floros et al., 2010); however, genetic engineering is a more recent technology that began with the development of Watson and Crick's model of the double helix in 1953 (OECD, 1999), and these days it underpins many biotechnological processes.

In fact, many of the first-generation biotechnology products and processes were enhanced through genetic engineering, and it is difficult to separate these technologies as genetic engineering provides the biotechnology 'tool box' for subsequent food products and processes. Adding to the potential for food production innovation is a set of technologies that include genomics, proteomics, metabolomics that provide a better understanding of the totality of metabolic engineering (Floros et al., 2010) that is controlling the metabolism of cells.

Genetically modified food has been promoted to alleviate world hunger; however, rather than using these innovations to help humanity, it is clear that companies such as Monsanto, Syngenta and Aventis have capitalised on these innovations. For example, the first genetically modified food, the Flavr-Savr tomato, reduced the cost of producing canned tomato products by about 20%. AqauBounty salmon may become the first genetically modified animal to be approved for sale as food (Diehl, 2018).

Although there have been issues about the acceptability of some genetically modified food, such as soybeans that were genetically modified by Monsanto to resist the herbicide Round-Up (Frewer et al., 2004), generally public antagonism arises when the public believes that exposure to these types of food is involuntary and uncontrollable rather than when they have a choice about consuming these products. Evidence supporting this view came from surveys by the International Food Information Council (IFIC, 2008, 2018), which found that worldwide concerns about genetically engineered food are low, probably through a lack of knowledge and because people are more likely to make a decision to purchase biotechnology-derived food only when it is shown to be designed for special benefits. For example, tomatoes were modified to produce higher amounts of lycopene, which is linked to lowering blood cholesterol levels. Another example of such a focus is genetically modified plants that produce vegetable oils so that the fatty acids extracted are more healthy, for example the production of linoleic acid, which is the beneficial fatty acid found in fish (Phillips, 2018).

Another specialised technological activity involving food is nanotechnology, which uses knowledge of the properties of matter that is within the range of 1–100 nanometres (nm). The potential benefits of nanotechnology for food technology are yet to be realised, and acceptance will depend on consumer attitudes, their trust in regulatory institutions, the motives of scientists, as well as information about the risks and benefits of these particular technological implications (Frewer et al., 2004).

Exploring the Dimensions of SAQs for Food Education

The case for using SAQs as a vehicle for exploring the issue of biotechnology, in particular genetic engineering within food education, can be justified by the recent worldwide focus on STEM education, which ensures that technology education has equal and significant status with other knowledge domains. In addition, it can provide a vehicle for integration when developing an appreciation of what it is to be technologically literate in the twenty-first century. When SAQ questions provide a context to examine the issues involved in both producing and consuming food using genetic engineering, it not only provides space to examine this technology but also ensures that there is an opportunity to examine how people's views about the issue are affected by their understanding and perception of risk and how morals and ethical issues can affect their judgement and demonstrate how religion and culture can affect consumer acceptance.

Consequently, this complexity of issues provides a rich context to explore these influences. The following sections will identify and describe some influences that affect people's views about a food-based SAQ, for instance the concept of risk and how it can affect consumer perception and acceptance, as well as how awareness of the differences between moral responses and the role of ethical frameworks can be used to support meaningful discussion. Also, worthy of comment is the effect of culture on people's responses to genetically modified food both in their consumption of the food and their attitude to the organisms involved in the biotechnological process.

Risk and Its Effect on Consumer Acceptance

Even though consumers stand to benefit from food crops with increased nutritional value that have an enhanced taste and aesthetic appeal, there is a concern that these benefits may come with an increased risk to the consumer (Falk et al., 2002). Because these innovations can involve risks and uncertainties, it is important to develop an understanding of the concept of risk because it affects decision-making (Simonneaux & Simmoneaux, 2009).

For many people, the world is a risky place. As Paul Slovic (the risk perception guru) comments, 'although we are more safe that ever before, in this technological age many people are frightened' (Slovic, 1987, p. 280). He observes that although experts employ risk assessment strategies to evaluate hazards (risky situations), most citizens rely on their own intuitive risk judgements. Regularly they ignore expert technical measurement that can be measured statistically or epidemiologically. Instead, it appears that most people perceive risk as a mulitdimensional phenomenon and integrate their beliefs with respect to the nature of the risk, the cause of the risk, the associated benefits and the circumstances of the risk into one consistent belief system. This integration of qualitative data occurs because they are more concerned with the nature of the consequences than the probability of them happening. To add to the complexity of 'lay people's' risk assessment, this also depends on whether such risk is imposed or voluntary and if it could affect future generations (Renn, 1992).

Consequently, it has been shown that technical risk estimates, historically provided by experts, do not impact on people's risk responses, and a risk that a person seems to have no control over seems more threatening than one that the person acknowledges as voluntary, even though the probability of harm is the same or less – for example nuclear explosions versus traffic accidents. For a similar reason, naturally occurring risks are perceived as less threatening than hazards that are the result of technological outcomes – volcanic eruptions compared to genetically modified rennets (cheese-making enzymes).

Biotechnology outcomes, especially those that involve genetically modified food, have a degree of acuteness, and there is substantial evidence that public risk perceptions and attitudes drive beliefs about the acceptability of this technology (Frewer et al., 2004). It is important to explore and critique how risk assessment is expressed both by experts and the lay community.

The New Zealand government's response to genetically modified organisms (GMOs) typifies an expert's accommodation to this layperson's view of risk. New Zealand legislation ensures that genetic modification is kept within containment (Plant & Food Research, 2018) and that the technology is used only as a research tool. This is an example of the precautionary principle, which is based on the assumption that one never knows what could happen, and consequently this technological activity should be limited. The shutdown of biotechnology limits technological innovation because of the view that hazards could occur in the future, will be unheralded and will damage our pure New Zealand image – so we must stay GE free. This response is at odds with the fact that it is highly likely that we are consuming processed food with genetically modified ingredients every day (New Zealand Listener, 2010). However, the Food Standards of Australia and New Zealand (FSANZ, 2019) has recently published a guide for manufacturers that attempts to identify the ingredients on the package, but giving exemption to highly processed foods that may be present (http://www.foodstandards.gov.au/code/Pages/default.aspx). This may provide some information but does not completely protect people who do not want to consume these highly processed components, such as corn (maize).

Identification of Ethical and Moral Issues Impacting on SAQs

It is recognised that risk perception is socially constructed, so it is important that moral and ethical issues are also considered when discussing the SAQ of genetically modified foods. Reiss (2003) explains the difference between morals and ethics by stating that morals are influenced by one's cultural and/or religious upbringing, but ethics are an external construct that provides a framework for analysis of thinking that can justify moral choices and actions in a particular situation.

In order for an ethical conclusion to have validity, Reiss (1999) proposes that there are three criteria that must be fulfilled in order to consider that an ethical analysis has taken place. They are as follows: (1) arguments should be supported by reason, (2) they should be conducted within a well-established ethical framework and (3) there should be a reasonable degree of consensus about the validity of the conclusions. He identifies major ethical frameworks that can form the basis of an ethical analysis. These include looking at the consequences of an outcome by identifying the benefits and risks, examining the rights and responsibilities of an action or outcome, identifying the role of autonomy by examining whether individuals have the right to choose for themselves or merely agree to a consensus view, and observing virtue ethics acknowledging that the good thing to do is to set the pattern or making sure that an ethical position identifies the perspectives of other cultural, spiritual and religious views (Reiss, 2007, 2010).

The rights of other species are of particular significance in an examination of the cultural influences on people's views of interspecific issues. For example, there needs to be an opportunity to take into account these issues in New Zealand. The Māori worldview (Te Ao Māori) considers that the 'wairua' – spiritual dimension of life – could be disrupted by the genetic engineering of organisms and that because they have a common 'whakapapa' (lineage) with other species, this cannot be tampered with (Harmsworth & Awatere, 2013).

The final section of this chapter discusses the SAQ in food production and consumption when genetic engineering is employed (Floros et al., 2010) and provides pedagogical strategies to illustrate how an awareness of these influences can not only deepen an appreciation of the issues that influence views about a SAQ but also enhance a discussion and examination of the SAQ in question.

Pedagogies to Enable Communication

When using SAQs as a context, it is important for teachers to be aware of the potential of a SAQ to be a 'hot' or 'cool' context and employ appropriate pedagogies that foster such an approach (Simonneaux & Simonneaux, 2012). For example, when an issue such as 'functional foods' is the SAQ, a 'hot' outcome would be students taking action about the issue whereas a 'cool' approach could involve students' developing higher order thinking skills through a 'Futures thinking toolkit' (https://www.sciencelearn.org.nz/resources/2439-futures-thinking-toolkit) where the issue is critiqued.

Levinson (2006) has developed categories of disagreement that could indicate the level of 'hotness' when an issue could be identified by the questions that are asked and the role of evidence that could be assembled. This level of evidence both for and against an issue could predict the level of potential conflict or lack of resolution that could occur in a classroom discussion. In other words, a lack of consensus amongst a group of people discussing the issue could be inevitable, not just because they could not agree. For example, a resolution is not possible because of a lack of evidence or the evidence is conflicting or there is no agreement about frameworks of understanding, for example between fundamentalist creationalists and evolutionalists.

However, in other situations, a pedagogy may ensure that a technological solution requires students to be aware of the issues and develop an outcome that promotes the ‘best fit’, for example using a set of questions that explore the impact of the technological outcome through technological modelling (France, Compton, & Gilbert, 2011). In particular, functional modelling allows an aspiring technologist to explore and evaluate the design concept in order to make decisions regarding its future development. Deepening this analysis through practical reasoning provides students with an opportunity to examine the sociocultural acceptability of outcomes, that is whether it ‘ought to happen’ in order to give expression to the critical normative element of technology (Compton, 2009).

Rather than exploring the impact both physically and socially of a food technology product or process, there could be an opportunity to explore one’s own views of the riskiness of the operation and/or outcome. Using a risk-benefit analysis, there is an opportunity to realise that no activities are risk free; also, compare your views with statistical data, for example the amount of saturated fat in a hamburger compared to fish and chips (Ratcliffe & Grace, 2003) where one lists all the benefits and risks – such as enjoyment, cost, vegetables present, gluten-free diet, accessibility (closeness to an outlet), pollution potential – that could also influence one’s choices. Even though these risks and benefits cannot be statistically assessed, they influence a consumer’s decision.

In all of these situations, it is important to develop pedagogies that develop students’ awareness of their positioning on the issue in question. Examples of these pedagogies are ‘Drawing the line’ and ‘Diamond Ranking’ (France, Mora, & Bay, 2010), where statements are ranked or pictures illustrating the outcomes of different biotechnologies are arranged so that students can explain the physical expression of their views. An extension of this pedagogy is identifying other perspectives by carrying out the above activities from the standpoint of different actors (France et al., 2010).

In order to understand how to communicate regarding moral and ethical issues, resources for identifying and distinguishing between these perspectives can help students recognise their moral and ethical stance (Reiss, 1999, 2007) before being asked to communicate about a SAQ. The Science Learning Hub has developed a PowerPoint that provides resources for a toolkit that enables student to study an issue from different ethical standpoints (Science Learning Hub, 2017). For example, when exploring an issue through a consequentialist framework, questions are asked to identify what is affected, what the possible benefits are and what the possible harms are. Then there is an opportunity to consider the conundrum of ‘what if one is harmed and another benefits’, who or what matters most, and finally which consequences will produce the most benefit and the least harm (Reiss, 2007).

Finally, communication about socially acute questions requires students to understand and agree on the ‘communicative virtues’ that a group of students need to acknowledge when discussing a SAQ (Levinson, 2006). These are the dispositions that promote open inclusive and undistorted communication which include: agreement on the rules of conduct and when participants are free to state their opinions, a moral obligation to speak the truth, and that all participants have equal rights to speak with respect expressed for all persons during the discussion (Levinson, 2006). When these rules are followed, there is a reasonable assumption that even a contentious SAQ under discussion will be managed so that students have the chance to become aware of different views, cultures and ethical frameworks and that difference is to be celebrated.

Then, reverting back to a simpler view that stimulates some ethical thinking, is to answer the question – 'What if?' that can provide the starting point of a consequence map (Ratcliffe & Grace, 2003). Michael Reiss (2002) provided an ethical dilemma when he described the issue of labelling GM processed food (tomato purée), whether such full disclosure was realistic and concerns about the ethics of non-disclosure.

Finally, it is important to acknowledge the importance of different types of evidence that might be brought into the discussion about a SAQ. For example, there is a great divide between the scientific world that produces empirical evidence as proof to explain issues and many cultural narratives that attempt to interpret the world and their position (Levinson, 2006).

What Are the Pedagogical Outcomes When Identifying a Socially Acute Question That Is Located Within a Food Context?

The most important pedagogical outcome when using SAQs as a focus for discussion is to make sure that students' views of the issue are broadened. Certainly, it is certain that one cannot assume that opinions will be changed. However, some of these strategies could ensure that students were aware of other perspectives and at least had a better understanding of their own views and the reasons for their strong opinions.

Biotechnology has the potential to provide a rich context for identifying SAQs for classroom discussion because food education is rich in contexts that provide emotional and cultural connections. This is because the normative decision that underpins all technological decisions is made visible, especially when SAQs provide the dimensions for discussion.

It seems that the writer of the OECD International Futures Programme was perspicacious in his summary of the importance of needing to listen to diverge views about biotechnology when he concluded this 2008 report:

> Many biotechnology innovations are claimed to match ethical needs … These innovations however could be used in unethical ways, as any instruments. Diverging views, therefore should not be simply considered useﬂess and temporary or caused by deficiencies of knowledge or rationality. They often express the inner ethical contradictions of biotechnological innovations as well as they reveal deeply-rooted ethical and cultural values which should be brushed aside … The development of biotechnology needs appropriate ethical debates to identify and match specific cultural and national concerns, and thus ensure public trust (Rigaud, 2008, p. 43).

There is a need for this discussion in food education so that innovation can be encouraged alongside an insightful and sensitive awareness of the issues involved.

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Chapter 19
Teaching Food Technology in a Secondary Technology Education Classroom: Exploring Ideas in Indigenous Contexts

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Abstract Indigenous knowledge pertaining to food is underrepresented in the Technology Education classroom despite indigenous contexts being replete with rich knowledge, skills and technology engaged in the production and processing of food. Teaching about indigenous food in the Technology Education classroom can enrich both the indigenous and non-indigenous learners' learning, transform education and ensure food security and health and promote culture. Therefore, this chapter explored indigenous food with specific reference to leafy vegetables and seeds and their processing and the technology involved. The chapter contributes knowledge around indigenous food which Technology teachers can learn about and ensure their integration in their teaching. Indigenous food technology also contributes alternative knowledge systems in the Technology Education subject.

Keywords Food technology · Technology education · Indigenous knowledge Indigenous contexts · Vegetables · Food justice

Introduction

This conceptual study explores the teaching of food technology in Technology Education in an indigenous perspective. It focuses on edible vegetables and seeds. Currently, the subject does not take full advantage of indigenous knowledge. A recognition and inclusion of indigenous knowledge can enrich its content and teaching and in turn benefit both indigenous and non-indigenous learners. The literature provides countless reasons why teachers should teach about indigenous foods. According to Kuhnlein et al. (2006), indigenous food systems provide a knowledge treasure which is typically overlooked and undervalued. Sub-Saharan Africa

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harbours approximately 1000 among the more than 45,000 available plant species which can be eaten as leafy vegetables, e.g. African nightshade (*Solanum scabrum*), spider plant (*Cleome gynandra*), pumpkin leaves (*Cucurbita muschata*) (Habwe, Walingo, & Onyango, 2008, p. 3).

I argue that these foods contain the health-protecting properties of non-nutrient bioactive compounds and are inexpensive and easily accessible, providing millions of African consumers with health-promoting compounds such as vitamins, minerals and antioxidants and even anticancer factors (Habwe et al., 2008). According to Kuhnlein et al. (2006), the health of indigenous people, their ecosystems and complexities of social-economic circumstances are intricately interdependent. They have a deep knowledge of their native foods for which their culture and practices are the bedrocks. Indigenous foods provide an alternative to the economically privileged lifestyles in high-income countries who are detached from the natural sources of food and their value and function (Kuhnlein et al., 2006). Heavy reliance on conventional foods makes one an easy target for diseases as a result of consuming poor-quality, imported and refined market and store food, e.g. refined food oils and sugared beverages (Kuhnlein et al., 2006). In the light of these grounds, indigenous people have much to teach the industrialised people who have become the target for common health conditions such as diabetes, hypertension, cholesterol disorders and obesity. Technology teachers should therefore not disregard indigenous foods in their teaching. The reasons advanced here motivate this need.

In the light of the above, this chapter proceeds by providing the theoretical lens framing the study, discussing indigenous food security, describing the production and processing indigenous food and the technology involved and lastly providing implications for the teaching of Technology.

Theoretical Lens Framing This Chapter

Community cultural wealth theory (CCWT), which is a tenet of critical race theory (CRT) (Yosso, 2002; Yosso & García, 2007), was considered relevant to unearth the wealth of food knowledge that resides in indigenous contexts. CRT examines and challenges the "ways race and racism implicitly and explicitly impact on social structures, practices and discourses" (Yosso, 2005, p. 70). By implication, CCWT favours the resurgence of indigenous knowledge against colonial practices which attempts to deny the same recognition it deserves. Therefore, the resurgence of indigenous knowledge is a commitment to transform schools from being the sites of oppressive forces against communities of colour (commonly known as indigenous, stigmatised as subaltern) to acknowledging the multiple strengths of such communities in order to serve a larger purpose of struggle toward social and racial justice (Yosso, 2005). CCWT, then, validates and acknowledges the knowledge that learners bring from their cultural contexts into the learning situation (Yosso, 2005). A collection of knowledge, skills, abilities and contacts possessed and used by indigenous communities from multiple sources such as storytelling, family histories, biographies, food, dress, technology, etc. can be better understood through CCWT. CCWT is premised on the aspirational, linguistic, social, navigational, familial and resistant capitals. These capitals interconnect and overlap and thus feed into each other (Yosso, 2005; Yosso & Garcia, 2007). These capitals are explained briefly according to these authors:

- Aspirational capital: This is the ability of the community to withstand and preserve the hopes and dreams for the future irrespective of the challenges and hindrances that it may face.
- Linguistic capital: This capital claims that learners come to school with multiple language and communication skills such as visual art, music and poetry.
- Social capital: This capital creates networks between people within societies. Neighbours exchange knowledge, skills and tools to provide both instrumental and emotional support, which in turn develops a sense of trust and openness for one another. It speaks of mutual aid instrument for collective beneficiation guided by ubuntu philosophy (respect, sharing, unity, etc.).
- Familial capital: Familial capital has reference to the cultural knowledge generated and spread within and between families and friends through sport, school, religious gatherings and other social community settings. It promotes a sense of community history, memory and cultural intuition. Furthermore, it maintains a healthy connection between the community and its resources and models lessons of caring, coping and providing which develop communities emotionally, morally and educationally.
- Navigational capital: This capital encapsulates the skills, inborn qualities and resources acquired without necessarily attending formal institutions, which can help one to manoeuvre through the social institutions.
- Resistant capital: This refers to the knowledge and skills that create oppositional behaviour to challenge inequality and help the communities to share their cultural wealth and use culture as a source of strength that can facilitate survival and resistance. It challenges occurrences of inequity, discrimination, unfairness, oppression and marginalisation instituted against indigenous people.

These capitals have fundamental implications for the teaching of Technology. These are presented later in the chapter.

Food Justice and Decoloniality: An Educational Right for Learners

CCWT is in tandem with the scholars' critical voices about the justice that must be shown to indigenous food against colonial forces that want to exterminate them. A representation of such criticality is discussed in this section. The consideration of food justice motivates the transformation of education by ensuring teaching about indigenous food in Technology Education.

Let me briefly define the four terms engaged in this section which are food justice, food sovereignty, colonialism and decolonisation. In this attempt, I also define coloniality and decoloniality as they show a shift in meaning from colonialism and decolonisation.

- *Food justice*: Food justice started as an extension of environmental justice and was motivated by the historical anti-oppression and civil rights efforts (Alkon & Norgaard, 2009). It is a social concern, economic matter and political problem (Baker, 2013), a force of resistance to the extermination of and undermining of indigenous food.
- *Food sovereignty*: Food sovereignty is closely related to food justice as it is an anti-colonial positioning about food (Grey & Patel, 2015) by the communities whose rights about food production, processing and consumption are violated by oppressive regimes.
- *Colonialism*: This is a political and economic relation of a nation or empire which imposes its sovereignty on another nation (Mignolo, 2005, p. 6) through invasion, conquest and direct administration (Ndlovu-Gatsheni, 2013). It threatens indigenous people's food security by removing them from their lands/environments.
- *Coloniality*: Unlike colonialism, which is confined to oppressive administrative practices, coloniality is the cognitive oppression maintained alive in books, performance criteria, peoples' self-image and aspirations, etc. as aspects of the modern experiences (Mignolo, 2005; Ndlovu-Gatsheni, 2013).
- *Decolonisation*: Decolonisation is an act of resistance against the invading force, achieved through the resurgence of indigenous consciousness levelled against colonialism (Sium, Desai, & Ritskes, 2012).
- *Decoloniality*: Unlike decolonisation, decoloniality is a redemptive and liberatory epistemology which seeks to detach from the cruelty of abstract universals, irrationality of the rational and despotic residue of modernity (Mignolo, 2005). It shifts the geography of reason from the west as the epistemic locale (Ndlovu-Gatsheni, 2013).

Kepkiewicz et al. (2015) locate the discourse about indigenous food within food justice and the recent activism and academic work on the concept. These authors argue that colonial practices have stifled indigenous food security by bulldozing indigenous plant species and robbing indigenous people of their lands. The current issue about land redistribution in South Africa in favour of the black majority may partly be understood against food justice and security. That is to say, the forced shifting of indigenous people from their lands by the past colonial regime frustrated indigenous people's subsistence farming and destroyed some of the indigenous plant species and crops. The reality about colonial injustices on indigenous food is also evident in other contexts. For instance, in the book *Decolonizing diet*: *Healing by reclaiming traditional indigenous foodways*, Bodirsky and Johnston (2004) relate the attempts of colonial policies to assimilate and destroy the indigenous knowledge of the First Nations of Toronto. According to these authors, despite the attempted assimilation, this cultural knowledge is currently undergoing a remarkable resurgence, attesting to indigenous people's resistance of colonial administration. In light of this, these authors claim that indigenous foodways are important for the health and well-being of indigenous North Americans.

Alongside food justice lies food sovereignty. Grey and Patel (2015) argue that since people are different, it should be expected that decisions about food sovereignty are different, consonant to the core set of principles such as women's rights, opposition to genetically modified food, etc. The National Collaborating Centre for Environmental Health (NCCEH) acknowledges this fact by claiming that "indigenous food sovereignty relies on the interconnections among culture, heritage, spirituality, and politics" (NCCEH, 2019, p. 1). Grey and Patel (2015) connect food sovereignty with the protection of the land systems, an issue cited above. They cite Morrison (2011), who also extends it to cover the long-standing sacred responsibilities to nurture healthy, interdependent relationships with the land, plants and animals that provide people with food.

Brimblecombe et al. (2014) spent 3 years of their ethnographic study exploring the social context of food choice and factors perceived to shape food choice among the Aboriginal adults in a remote Australian community. They found that knowledge, health and resources that support food choice were considered shaky due to the western-imposed diet and overreliance on the familiar staples. As a result, the participants in the study felt ill-equipped to emulate the traditional pattern of knowledge transfer through passing the food-related wisdom to the young generations. On the other hand, the traditional food system was considered key for providing the framework for learning about the contemporary food environment. Teaching learners about indigenous food can then help restore the dignity that oppressive forces despise.

Part of the resurgence of indigenous knowledge lies in the fact that contemporary indigenous communities are building on the oral traditions with written stories of food gathering and recipes to revitalise the food knowledge, cultural integrity and community. According to Bodirsky and Johnston (2004), indigenous cookbooks provide the opportunities to share information about the traditional culture and food knowledge. Such books contain recipes that are alternatives to the conventional ones. But since indigenous people live very close to nature, the earth is their main source of food knowledge. Johnston (2004) states in this regard that the North American Indians did not have books but that they had the greatest book of all, i.e. mother earth, which is a book that preceded all other books. Writing from the Indian context, Pandey, Chhonkar, Singh and Khumu attest to this fact:

> There has been cumulative learning from generation to generation among the tribal societies living in close vicinity of the nature. They process and prepare several types of peculiar food and beverage items which are location specific and made with the help of traditional knowledge (Pandey, Chhonkar, Singh, & Khumu, 2017, p. 633).

Pandey et al. (2017) studied food knowledge among the Monpa tribe of Tawang District of Arunachal Pradesh. They interviewed 120 participants. The findings of their study revealed that the Monpa people are the masters of methods of food preparation for the food items such as thukpa, momos, khura and zan using crops such as rice, wheat, maize and barley. Their knowledge is also demonstrated in beverages such as sing-chang, bang-chang, aarak and marching which are prepared from fermentation, distillation and the brewing of food grains. These authors claim that this cultural diversity should be preserved in India for its distinctive feature which has the potential for tourism industry. I contend that the main reason for its preservation should be the promotion of the culture itself. Furthermore, educating the young about indigenous food can ensure the preservation of cultural knowledge. This knowledge should be brought into the Technology Education curriculum.

Lastly under this section, acts of food injustices mostly affect women because they are the ones who engage in food-related activities more than men. Yousry and El-Shafie (2015) argue that indigenous food is an opportunity to promote recognition for women as they make 43% in agricultural activities in developing countries. Masekoameng (2007) and Sudan (Ibnouf, 2012) also argue that women aged 40 and more are more knowledgeable in food than men. I argue that the inclusion of indigenous food in Technology Education has the potential to increase female learners' participation and performance in the subject. The inclusion also promises to restore the dignity of indigenous knowledge as a whole and increase the employment of indigenous teachers as the authentic knowledge holders.

Indigenous Food and Their Production and Processing Technology

Indigenous communities display the technological knowledge and skills of producing and processing food (refer to Table 19.1). As mentioned above, this knowledge and skills have however not been recognised as they are thought of as slow and low-tech. But in the high-tech world of today where there is a global concern about the methods which destroy the natural environment, indigenous methods and techniques prove to be the answer—high technologies should be combined with low biotech ones to neutralise the negative impact of technology on the environment. In Table 19.1, the right column acknowledges the limitations of indigenous methods wherein learners' design activities and creativity can blend indigenous and conventional methods. I also contribute critical ideas in that column as to why those methods may be preferred.

Taking this section forward, I present brief discussions on the technology of sun-drying and leafy vegetables and seeds/grains as food. Sun-drying food in indigenous contexts is the common processing technique. However, it may expose food to dust, rain, wind, insects, birds, rodents and domestic animals, microorganisms and formation of mycotoxins (Habwe et al., 2008). When I grew up, I witnessed dinawa being spoiled by an insect called tshupha in Setswana. While industrialised equipment can help mitigate these challenges, it is not easily affordable, has high maintenance costs and is mostly outsourced technology which is made outside the indigenous context. A solution lies in the advice of Habwe et al. (2008, p. 5) that

Table 19.1 Technology for processing indigenous West African food (adapted from Aworh, 2008, pp. 2–3)

Technology/ operation	Function and objective	Main features and/or limitations
Preliminary/post-harvest operations		
Threshing	To detach grain kernels from the panicle	Done by trembling on the grain or beating it with sticks. It is a labour-intensive, inefficient and low-capacity technology. Collective engagement called letsema (people organise themselves to work as a group) and environment-friendly technology makes labour intensity preferable and counteracts low-capacity technology. As a collective, people sing or converse as a cultural practice and to gain strength.
Winnowing	To separate the chaff from the grain	Done by throwing the grain into the air. It is a labour-intensive, inefficient and low-capacity technology. Singing while performing this activity builds strength in the one performing it. Environment-friendly technology counteracts low-capacity technology.
Dehulling	To remove grain from its outer protective casting	Done by pounding the grain in a mortar with pestle. It is a labour-intensive, low-capacity technology and there is excessive grain breakage. Collective engagement/letsema and environment-friendly technology make it a preferred method. Women performing this task gain strength by singing and conversing. Grain breakage could fast-track the grinding of grain which must be eaten in its fine format, e.g. maize into maize meal.
Peeling	To separate the peel or skin from the edible pulp	Manual peeling with a knife or similar object. It is a labour-intensive and low-capacity technology; there is loss of edible tissue. It seems not to be a problem—in cultural functions, women are normally observed engaging in the peeling activities while they enjoy conversing and singing.
Milling		
Dry milling	To separate the bran and germ from endosperm	Carried out by pounding in a mortar with pestle or grinding with stone. It is a labour-intensive, inefficient technology with limited capacity. Collective engagement/letsema makes it a preferred method. Labour intensity is preferred and technological inefficiency may not be seen as constraints by indigenous people. Rather, Labour-intensive activities promote social cohesion and cultural values, young women/men are taught how to do things in the process, etc.

(continued)

Table 19.1 (continued)

Technology/ operation	Function and objective	Main features and/or limitations
Wet milling	To recover mainly starch in the production of fermented foods	Done by pounding or grinding after steeping. It is laborious with limited capacity, resulting in losses of protein and quality. Collective engagement/ letsema makes it a preferred method. Limited capacity is counteracted by collective engagements.
Heat processing		
Roasting	To impart desirable sensory qualities, enhance palatability and reduce anti-nutritional factors	Peanuts are roasted by stirring in hot sand in a hot flat-bottom frying pot over a hot flame. It is laborious with limited capacity. Collective engagement/letsema makes it a preferred method; thus it counteracts limited capacity.
Cooking	To contract curd and facilitate whey expulsion, reduce microbial load, inactivate vegetable rennet and impart desirable sensory qualities	Loose curd pieces are cooked in a pot over wood fire. It has limited capacity. Collective engagement/letsema makes it a preferred method; thus it counteracts limited capacity.
Parboiling	To facilitate milling and enrich milled rice with B-vitamins and minerals	Done by steeping paddy rice in cold or warm water followed by steaming in bags in drums. It has limited capacity and poor-quality products. Collective engagement/letsema makes it a preferred method; thus it counteracts limited capacity.
Blanching	To inactivate plant enzymes and minimise oxidative changes leading to deterioration in sensory and nutritional qualities, e.g. enzymatic browning	Done by heating slices in hot water in a pot for various durations. It has limited capacity and leads to low-quality products. Collective engagement/letsema makes it a preferred method. Collective engagement/letsema makes it a preferred method; thus it counteracts limited capacity.
Drying		
Shallow layer sun-drying	To reduce moisture content and extend shelf life	Done by spreading the product in a thin layer in the open. It is labour-intensive, requires considerable space, has moisture that is too high for long-term stability and has poor quality. Collective engagement/letsema is preferred, making labour intensity enjoyable rather than endurable. Space is not a constraint in open home environments.
Smoke drying	To impart desirable sensory qualities, reduce moisture content and extend shelf life	Meat chunks are exposed to smoke in earthen kiln or drum. There is limited capacity and the product is of low quality. Collective engagement/letsema counteracts limited capacity and makes the method a much preferred one.
Fermentation		

(continued)

Table 19.1 (continued)

Technology/ operation	Function and objective	Main features and/or limitations
Effervescence	To extend shelf life, inhibit spoilage and pathogenic microorganisms, impart desirable sensory qualities and improve nutritional value or digestibility	Done by selecting natural fermentation with microbial flora by means of substrate composition and back-slopping. There is low capacity and variable quality. Collective engagement/letsema counteracts limited capacity and is much preferred.

"solar drying or freeze drying and vegetable development using simple techniques combine the advantages of traditional and industrial methods, namely low investment costs and high product quality". Kwaira and Gumbo (2017) engaged in a community development project study. Food-processing machines for maize meal, peanut butter and cooking oil were made by indigenous farmers in the Makonde District of Zimbabwe. The farmers operated and maintained the machines by themselves. The machines are the example of combining indigenous knowledge and skills with the conventional ones.

Directorate Plant Production (2013) relates indigenous food practices. Accordingly, pearl millet is processed as a whole, cracked or ground into flour, dough or grain-like rice. These may be processed into fermented breads, foods and porridge. As indigenous cultures have multiple uses of a product, they also grow pearl millet for silage and hay production. The residue and green plants can be used as building materials for fencing, thatching and making basketry. Grain sorghum, which is commonly known in Setswana as mabele, is mainly used for making porridge, unleavened bread, cookies, cakes, couscous, etc. The parched seeds are used as coffee substitutes. They are also the important animal feed such as pigs. Cowpea or dinawa leaves are eaten as vegetables, either fresh or dried. The immature pods and dried pulse can also be used as vegetables. The entire plant may be used as livestock fodder. The immature seeds of Bambara groundnuts (ditloo) can be eaten boiled or grilled, while mature ones can be roasted in oil or grinded to make flour. They can also be boiled and mixed with maize kernels. The roasted grinded meal can be used as a substitute for coffee. The seeds can be soaked and used to feed livestock. Leaves can also be used to feed livestock.

According to Notsi (2012), when the seeds are dry, women dispatch them by shaking and storing them in bags or clay. The seeds are "protected from over drying by covering them with leaves or other specially prepared mixtures", or by storing them in bags or clay pots, before winnowing to separate them from chaff (Notsi, 2012, p. 11). Seed collection follows cultural protocols in which women and men arrange for seed collection, transport, extraction, processing and storage (Notsi, 2012). Women also involve children in the collection of seed, during which they (children) are taught through demonstration and discovery methods (Notsi, 2012). Women are more knowledgeable in indigenous knowledge about food security (Hlompho, 2014). Hence, they play a major educational role in teaching the young ones who stick close to them. However, due to their exposure to the western knowledge and mass media, children lack interest in indigenous knowledge. This is exacerbated by the fact that people move away from indigenous food because of acculturation, lack of food access and availability, food insecurity, environmental pollution and climate change (NCCEH, 2019).

Notsi (2012) conducted a comparative case study on the utilisation of African indigenous vegetables and farming methods in food security and nutrition between Tsitas Nek in Lesotho and Mabeskraal in South Africa. As part of her methods in the study, she interviewed elders. The findings of the study revealed that both communities depended on African indigenous vegetables such as theepe (*Amaranthus*) and morogo wa dinawa (*Vigna unguiculata*) for food security and nutrition. The communities used indigenous farming methods to cultivate these vegetables as they are cost-effective, environmentally friendly and sustainable compared to the conventional ones. Most importantly, Notsi found that the knowledge, techniques and sociocultural protocols and skills of cultivating indigenous vegetables using African indigenous farming methods are directed by the elders. Notsi (2012) concluded that modern and profit-driven farming methods tend to marginalise indigenous farming methods which have the potential to promote biological diversity. However, Notsi acknowledged the strengths and shortcomings of both methods and suggested a dual approach.

Implications for Teaching Technology

There are implications for teaching Technology which flow from the deliberations in this chapter. Since the crux of Technology Education lies in teaching through design, learners can be assigned design projects which combine indigenous processing technology with conventional technology. Care should be taken for conventional technology not to override indigenous technology. Indigenous foods are under-exploited and under-utilised because of constraints that they face such as processing, distribution, marketing and nutrition information. Technology learners may be given design scenarios so that they can design solutions that can market indigenous foods to revalue them.

In terms of CCWT above, the following may be considered in the teaching of technology:

- Aspirational capital: Develop aspirations in learners through the stories and advice within the social and familial contexts to allow them to dream of possibilities and their future academic achievement in the face of hindrances levelled against indigenous knowledge. Teach them about the wealth of indigenous so that they can venture into indigenous careers in future rather than seeing conventional careers as the only option.
- Linguistic capital: Consider the multilingual ways and communication skills for learners to express their learning. Allow code-switching and other systems of communication available in indigenous communities to facilitate the learners' understanding of concepts and principles.

- Social capital: Organise the learning activities such that learners can learn from and support each other by exchanging and co-constructing knowledge, skills and tools in relation to their cultural environments. This will help them to develop a sense of trust and openness towards one another. Teachers should consider adopting the theory of letsema in this regard.
- Familial capital: Do not teach learners "away" from their communities, i.e. avoid culturally irrelevant teaching. Instead, connect teaching with the communities to the extent of inviting the communities as partners in teaching and learning. Thus, for the teaching of Technology to benefit learners maximally, it should not be confined within the four walls but connect with the communities out there. A model of teaching in the open or indoor-outdoor classrooms should be considered as an add-on to the classroom-based one—indigenous people teach the young ones in the open as they engage in activities. There is a wealth of knowledge and methods of teaching existent in indigenous communities waiting to be explored.
- Navigational capital: Identify the available social institutions within indigenous communities which may harbour knowledge and skills that can facilitate meaning learning in Technology Education. Also, tap on the inborn qualities and skills in the learners which can be instrumental in the facilitation of learning. This will require an open attitude from the teacher to learn along with his/her learners.
- Resistant capital: Teach Technology with a postcolonial or transformational mindset in response to resistant capital—consider an indigenous definition of technology down to content and teaching methods. Critical perspectives about the merits and demerits of both indigenous technology and conventional technology should be considered so that new solutions can be arrived at which blend the two technological modes based on what is good from both sides.

Education should be a remedy to loss of life—we teach for solutions in the real environments. As indicated in this chapter, the conventional technology and its food processing function is blamed for causing life-threatening conditions. Food design activities should therefore be extended to learning about health and food security issues. Empowering learners to explore indigenous food will add to the variety of available foods and their health properties. Teachers should also, as part of learning, empower learners to learn about the cultural practices accompanying planting down to the processing of indigenous foods so that they will know and respect the cultural boundaries pertaining to food, e.g. harvesting follows cultural protocols and happens at certain times declared by chiefs. Teaching food technology has the potential to increase learner participation among women as traditionally women take a lead in this field. This will deal with the myth about technology being a men's career. Lastly and most importantly, the wisdom of elders may not be overlooked; hence, it makes an important learning resource. Learning activities about investigating solutions can be planned such that learners are encouraged to talk to or interview elders in their communities.

Conclusion

The aim of this chapter was to explore the teaching of food technology in Technology Education from indigenous perspective. To achieve this aim, CCWT was considered to frame the chapter. Relevant terms around food justice were defined. The food technology and its function, features and/or limitations are explained in Table 19.1. Implications for teaching Technology were drawn ultimately. This chapter shows that indigenous contexts are endowed with the rich knowledge, skills and technology pertaining to food harvest, processing and consumption. The low technology used to process this food poses less threat to the human body with reference to diseases and conditions that have been cited in the chapter. This provides one of the main reasons, apart from the maintenance of food security, sovereignty and culture, to teach about indigenous food. Having said this, however, there is an opportunity for learners to explore and design hybrid methods and technology that can address certain limitations in the production and processing of indigenous food. The implications for teaching Technology provide ideas that could help teachers to plan activities that can affirm and promote indigenous knowledge pertaining to food technology.

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Chapter 20
Learning Cultural, Ecological and Food Literacies Through the Gumbaynggirr Pathway of Knowledge Project

Angela Turner

Abstract This chapter presents research from a project collaboration undertaken in New South Wales, Australia, between a rural primary school, local Aboriginal Gumbaynggirr Elders and Southern Cross University. The research responded to an expressed school and community need for teacher professional development on local Aboriginal culture. The aim was to understand food values at the core of Australian native food and plant knowledge systems, coupled with developing transferable teaching strategies for the classroom. Exploring and understanding natural food sources were triangulated between Australian Aboriginal science and Western science, visualised through nature journaling. Accordingly, the research methodology assigned three settings of engagement: (1) the embedding of local Gumbaynggirr perspectives in curriculum delivery across years K-6 in an integrated, culturally sustaining and cross-curriculum manner (cultural literacies), (2) the embedding of sustainability perspectives to better understand earth's natural systems and food supply sources (ecological literacies) and (3) the embedding of food technology and design applications, to enhance student learning on Australian native plants as a science, an art, and a sustainable, healthy lifestyle (food technology and design literacies].

Keywords Teacher professional development · Cross-culture · Food technology Ecology

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Introduction

> …the original inhabitants have carefully stewarded this land for the entire time they have lived here, and have the oldest unbroken culture in the world (Pascoe, 2016).

The (Australian) Aboriginal and Torres Strait Islander (ATSI) people as knowledge holders embody traditional cultural understandings that involve spiritual, social, environmental and educative relationships to 'country'. While ATSI societies are very different today compared to their earlier economic, social and demographic characteristics, their connection to country remains intrinsic to their 'being' (Langton, 2011; Langton, Palmer, Tehan, & Shain, 2004). The research described in this chapter addresses non-Aboriginal teachers' efficacy to communicate authenticity and meaning about a culture they may not have knowledge of nor any personal connections with to draw upon as a 'lived experience' (Nakata, 2007, 2011). The tension between maintaining old, historical Aboriginal ways and knowledges and demonstrating that such knowledges are alive, contemporary and changing is an ongoing challenge for Australian society and education systems (Turner, Wilson, & Wilks, 2017).

The motivation to improve Aboriginal and Torres Islander (ATSI) curriculum and classroom pedagogies was based on the ongoing issue of non-ATSI teacher preparedness to teach ATSI histories and cultures (Turner et al., 2017). Literature suggests that non-Aboriginal tokenism in the classroom has resulted in the teaching of 'stereotypes of Aboriginality' (Harrison & Greenfield, 2011, p. 66). Thus, the aim of the research was to promote a cooperative model of social inclusion and management for sustainability; thus within this framework, the research questions focused on:

1. In what ways can schools and teachers enrich learning with understandings of local Aboriginal narratives developed with and endorsed by Elders and the community?
2. How do we create spaces for teaching these Aboriginal understandings and K-6 curriculum perspectives?
3. Accordingly, what knowledge, competencies, attitudes and skills do teachers need to learn in relation to enhancing teaching Aboriginal understandings and perspectives?

The research project undertaken during 2014 provided an opening for the primary school educators to undertake professional development on becoming more proficient and confident in the field of Aboriginal and Torres Strait Islander education in light of the Australian Professional Standards for Teachers. The specific Focus Areas included Standard 1, know students and how they learn—1.4 Strategies for teaching Aboriginal and Torres Strait Islander students—and Standard 2, know the content and how to teach it, 2.4 Understand and respect Aboriginal and Torres Strait Islander people to promote reconciliation between Indigenous and non-Indigenous

Australians[1] (Australian Institute for Teaching and School Leadership, 2014, pp. 9 and 11).

The importance of undertaking this joint effort produced a connection between 'indoor' and 'outdoor' classroom pedagogy practice. Therefore, all students (Aboriginal and non-Aboriginal) discovered that the Aboriginal worldview is different from the European worldview but that the two should stand parallel with one another (Green & Opplinger, 2007). Aboriginal and Torres Strait Islander histories and culture and sustainability are two of three cross-curriculum priorities in the Australian Curriculum the public primary school was actualising in 2014.

A significant aspect that emerged from the implementation of the new Australian Curriculum was the push for school gardens, specifically 'bush tucker gardens' into the school setting, largely due to the cross-curriculum priorities, Aboriginal and Torres Strait Islander priority and the sustainability priority. Accordingly, this has opened up the opportunity of cross-cultural knowledge and understandings on environmental sustainability and the connection between eating healthy foods, understanding the nutritional and medicinal benefits of native plants with the prospect of improving lifestyle quality and health.

> For too long a time, Aboriginal people have been disconnected from the lands and waters. It's vital that we, as the first Australians, share and teach our cultural knowledge of such an enriching culture that has existed since before recorded history. We now need to reconnect to all to become caretakers. We connected to the land and animals for our foods, health and healing for generations. Today, we have the opportunity to continue sharing our knowledge, so we can ensure the planet is well looked after today and into the future (Verma, 2018).

Making partnerships with Indigenous communities brings their perspectives and cultural knowledge into the school, creating a new knowledge set for all. This was a significant element of the Gumbaynggirr Pathway of Knowledge project because it integrated and advanced local Gumbaynggirr culture, historical perspectives and food knowledge systems, coupled with land management practice and local narratives endorsed by Gumbaynggirr Elders and the local community. The research project identified an unrealised and rich opportunity for cultural learning, on utilising existing yet ancient plant types, and provides opportunities for students to learn the value of knowledge of such plants and knowledge that both Australian Aboriginal and non-Aboriginal teachers and practitioners continue to teach.

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[1] '"Aboriginal" and "Torres Strait Islander" refer to different groups of peoples. Aboriginal refers to the original peoples of mainland Australia. Torres Strait Islander refers to the original peoples of the 274 islands located north of Australia between the tip of Cape York in Queensland and Papua New Guinea' (Common Ground, n.d.). 'The term "Indigenous" is used to refer to both Aboriginal and Torres Strait Islander peoples' (Australian Human Rights Commission, n.d.).

Background

The Gumbaynggirr Pathway of Knowledge project was a springboard initiative from a previous Parents and Community Engagement (PaCE) grant in the school during 2012.

The Gumbaynggirr Pathway of Knowledge project was funded through an internal Southern Cross University (SCU) grant. The school enrolment at the time comprised 98 students, where 12% (15) of the school enrolment were identified as Australian Aboriginal students. The school is situated on the land of the people of the Gumbaynggirr nation and positioned on the last five acres of natural habitat in the immediate locality that contains much valuable flora and fauna habitat. The locality where the school is situated is significant in terms of the degree of Aboriginal 'custodianship' for this area (Turner et al., 2017).

The school Principal initiated engagement with the Southern Cross University (SCU) research team with an articulated desire to develop and foster a rich understanding of local Aboriginal Gumbaynggirr culture, historical perspectives and food knowledge systems for the teaching staff and students. A key aim was to design 'garden rooms' in the existing native bush section of the school site with the prospect to establish a 'Pathway of Knowledge' as a self-guided educational walking trail of plants traditionally used by Aboriginal communities. This became known as the 'Gumbaynggirr Pathway of Knowledge' that symbolised respect, valuing and collectively the bringing together of the Gumbaynggirr Elders, community stakeholders, the acting principal (at the time this project occurred), teachers, volunteer participant teachers, students and the SCU researchers. The project also involved professional development for teachers on working in collaboration with the Gumbaynggirr Elders, learning more about the geographic locations of native Australian plants, the structure of the plants and the nutritional and medicinal benefits (Turner et al., 2017). Additionally, the project offered teachers the opportunity to learn about food sources, soil, water, pests and fauna relationships. They also learnt how to substitute non-native plants with native plants for culinary purposes. The expectation was that this information would flow into the K-6 classrooms and support student learning on biodiversity from a young age through authentic learning experiences inside and outside of the classroom.

Relevant Literature

Literacy

There are two general definitions for 'literacy' based on the Merriam Webster Dictionary and the Oxford English Dictionary: (1) the ability to read and write and (2) knowledge or capability in a particular field or fields (McBride, Brewer, Berkowitz, & Borrie, 2013). The United Nations Educational, Scientific, and Cultural Organization describe literacy as:

> …a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society (UNESCO Education Sector, 2004, p. 13).

Literacy has previously been reconceptualised as a tool for data construction within the cognitive science sector in relation to obtaining new knowledge through reasoning or problem-solving (Michaels & O'Connor, 1990), yet Cardwell (2005) put forward that while many forms of literacy exist, and for each literacy there is an integration of a suite of skills, he questions whether education is on the right course by focussing too heavily on reading, writing and mathematics as these alone are not a true indicator of a student's potential. This is extant today through the compulsory National Assessment Program Literacy and Numeracy (NAPLAN) test in Australian schools where:

> NAPLAN tests identify whether all students have the literacy and numeracy skills that provide the critical foundation for their learning, and for their productive and rewarding participation in the community. Students are assessed using common national tests in reading, writing, language conventions (spelling, grammar and punctuation) and numeracy (Australian Curriculum Assessment and Reporting Authority, 2016).

It is clear that informed and capable citizens in the twenty-first century would be well served to be both literate and numerate in the purest sense of the terms and increasingly be culturally, ecologically, scientifically and technologically literate (Turner, 2013). Naturally, the notion of literacy has evolved noticeably from its beginning in the potential to read and write. Specifically over the last 50 years, expectations for a literate citizenry had been improved to include the capacity to realise, make informed selections and act with compassion to complicated issues and problems dealt by society in these days (McBride, 2011).

Cultural Literacies

Australian Aboriginal tradition and kinship are specific to Australia's First People, but vary significantly in nature, throughout regions, clans and language clusters (Pearson, 2009). Traditionally, Aboriginal people possess their own set of language and lore, competencies and values that are passed on to the succeeding generation from the Elders—caretakers who keep the historic lore for memorising myths, songs, rites and traditions pertaining to technological insight, material understandings and food supply knowledge. Australian Aboriginal agency in agricultural farming and harvesting had existed for thousands of years until white settler colonisation occurred from the late 1700s onwards (Pascoe, 2014). However, the way in which ATSI culture is presented in typical Australian classrooms can be identified as offering a fragmented approach from a Western assimilationist perspective based on a misguided perception that has marginalised Aboriginality, creating a void of a deep understanding about our First Nation people and failing to establish a link to their culture (Michie, Anlezark, & Uibo, 1998).

Pascoe (2014) points out that science demarcates the two cultures in many ways, i.e. Western science is a controlled activity while Aboriginal science is a lifestyle—not as a primitive hunter and gatherer nomadic lifestyle (as commonly portrayed in curriculum and teaching and learning resources) but as a result of domestication. Pascoe furthers that diaries written by early explorers and colonists evidence a history of Aboriginal population and permanent dwellings, agriculture, aquaculture, baking, storage and preservation. However evidence suggests the First People's sophisticated economy, based on social, technological and environmental expertise, was ignored by Western people due to prejudice and contempt as their view was convinced that its superiority in Western science, economy and religion should direct the economy as a colonial ambition. Notwithstanding the historical backdrop, Nakata (2007) reminds us that Aboriginal stories and practice involving the natural and social environment are kept alive through traditional language, yet the stories change according to the conditions on which this knowledge and continuing practice are contingent.

For teachers, curriculum gaps and inadequate pre-service training create challenges in the classroom (Andersen, 2012; Hart, Whatman, McLaughlin, & Sharma-Brymer, 2012). It is suggested this may be due to the lack of Aboriginal and Torres Strait Islander academics in higher education and schooling, with non-Aboriginal executive staff often driving course content offerings, with little to no experience in Aboriginal and Torres Strait Islander culture and therefore with no capacity to tell Aboriginal stories in culturally responsive ways (Austin & Hickey, 2011; Carey & Prince, 2015; Mackinlay & Barney, 2014). Given that teachers direct curriculum content, it would be reasonable to suggest there is a lack of Aboriginal and Torres Strait Islander curriculum writers at a school level as a result. This may explain the disembodiment of information that Nakata (2007) identifies as:

> ways that dislocates it from its locale, and separates it from the social institutions that uphold and reinforce its efficacy, and cleaves it from the practices that constantly renew its meanings in the here and now (p. 9).

In the contemporary classroom, Yunkaporta and Kirby (2011) emphasise the importance for a 'common ground' with Aboriginal and non-Aboriginal ways of learning—a common pedagogy that balances the two worlds in the classroom yet extends a balanced partnership between community and the school. Yunkaporta (2009) puts forward a framework that acts as a starting point and may be changed to suit each school's needs according to the ways and processes of the local Aboriginal community. Intrinsic to these pedagogies are values, protocols, systems and processes that cannot exist unless there is a connecting synergy or collaborative interaction between Aboriginal and non-Aboriginal teaching staff. The eight-way pedagogy framework is expressed through eight interconnected pedagogies that involve (1) narrative-driven learning, (2) visualised learning processes, (3) hands-on/reflective techniques, (4) use of symbols/metaphors, (5) land-based learning, (6) indirect/synergistic logic, (7) modelled/scaffold genre mastery, and (8) connectedness to community (Department of Education and Communities, 2012, p. 5, cited in Turner et al., 2017). The framework was used in relation to oral stories about how the Pathway of Learning evolved over time, how local people were organised into clan groups with totems according to lore and as a way of having an ordered way of living through the magic of 'Gurruuja', the whale (the totem for this local area). Other oral stories involved sharing of knowledge on plant species and their medicinal and nutritive benefits. Visualisation processes were guided through drawing plants by way of observation and using topography tools, land links, symbols and images for designing the garden rooms.

Additionally, Paris (2012) highlights the need for a culturally sustaining pedagogy in teaching and learning, for example, through the land and the native plants. This concept extends the work of Brown (2010), which indicates socially validated learning experiences can be made from both 'inside' and 'outside' the classroom as an 'opportunity to connect spiritually and personally with themselves, with one another, their educators and the land' (p. 15). The research considered a relationally responsive approach that illustrates in a localised context, Aboriginal ways of knowing, doing and valuing (Turner et al., 2017).

Ecological Literacies

Ecological literacy involves 'understanding, caring and sensible competence'. It involves figuring out how humans interact with ecosystems and how this may also be achieved in a sustainable way (Orr, 1992). It is not surprising that in recent years, eco literacy has evolved as a multidisciplinary and holistic education movement that incorporates 'humans as part of nature' (Hammarsten, Askerlund, Almers, Avery, & Samuelsson, 2018, p. 2). They advocate outdoor experiences act as a capacity-building environment for children and young people to 'care and respect other organisms, and leads to an understanding of the natural systems' (p. 2) which in turn strengthens their sense of being and place in the world. In their research project undertaken during 2013–2015, Hammarsten et al. (2018) describe the Holma forest garden in Sweden as a 'virtual food pantry' where they could snack on fruit and vegetables, water the plants, feed the compost or observe insects in the soil. There is a large body of literature that has long advocated this outdoor interaction which promotes a healthy and well-balanced platform on which children and young people develop positive connections with 'seed to feed' attitudes and values (Blair 2009; Chawla, 1999, 2007, 2015). While this is not a new concept, it nonetheless acknowledges Australian Aboriginal First People (globally) and that the spiritual and cultural fibre of social organisation and the connection between people and land is critical for successful food sustainability understandings. Our First People were after all the first 'environmentalists' as caretakers of the Australian environment.

Food Literacies

Key economic drivers in the food industry for over the past 15 years and societal values have influenced innovations in the Australian Aboriginal native bush food industry; links between nutrition, naturopathy and food; and the strengthening of values that link to eco-sustainability. In terms of keeping the school study of food education contemporary, we can no longer afford to continue presenting the subject as a narrow endeavour of using cooking tools, or just culinary skilling (Turner & Seemann, 2006). Given food technology and design involves technological activity in nearly everything grown or made, it is critical that students are exposed to the 'whole menu' as a sustainable food system and one that is recognised by students as being able to maintain the health of people but is not wasteful of top soil, water, fossil fuels and other finite resources. Where the combination of increasing human population and resource use is costly in terms of global biodiversity, it cannot be understated that food supply chains for future generations remain a significant issue in relation to sustainability in the supply of nutritious foods. It is therefore critical that teachers and educators form a coherent picture of sustainability in terms of food and to integrate sustainability concepts that provide a more holistic and real-world context to learning (Turner & Seemann, 2010). There is a need to apply new 'ways of knowing, ways of doing and ways of being' in food education that offer insight into the food supply chain; therefore, a key question arises: How do we educate and produce clever, creative and 'technate' people for sustainable food futures?

> Technate people study the context of a problem in a comprehensive way before selecting the knowledge, tools and resources needed to progress a solution. This comprehensive assessment of *purpose and context* is [seen as] critical to the [practical] success of the solution (Turner & Seemann, 2010, p. 7).

Ancestral Australian Aboriginal food knowledge is a nested system where each part defines the purpose and context and where each element is interdependent of each other to achieve a balanced outcome for technological activity (Turner & Seemann, 2010). Three elements represent both resources and constraints evident in all forms of technological practice: a systems-thinking approach that includes mutually reliant relationships between people, tools and the consumed environment, driven by purpose and contextual factors (Turner, 2013). It is this concept of balance in a social, environmental and technological setting that provides a platform for the teaching and learning of children and young people to develop as active participants in their world. On balance, being 'technate' is an extension of being literate and numerate, and it can be argued that this approach is appropriate in any environment.

Research Design

Methodology

An exploratory model was developed to investigate gaps in learning on native Australian plant knowledge. The selected *Purpose* and *Context* of learning for this project interprets learning through three key literacies as the ontological and epistemological framing: (1) cultural literacies (ways of knowing, ways of doing and ways of being), (2) ecological literacies (nature journaling) and (3) food literacies (nutritional and medicinal food design coupled with cooking and sensory tasting applications). In the centre of this, nature journaling was used as a way to explore and document the natural world through art, writing and science. These representations were necessary to support scientific plant observations on noticing details of plant structure and recognition of different flora species.

An integrated whole school teaching programme was designed to include both ‘indoor and outdoor’ classroom teaching and learning spaces. The aim was to connect learning to local values, needs and knowledge. Interactive activities were realised through the native bush tucker garden as the ‘outdoor’ educational setting. Engaging ‘indoor’ activities exposed teachers and students to an innovative teaching strategy using real-time ‘video demonstration’ as a method to develop drawing literacies for the nature journal.

One-day sessions per week over a 10-week school term assigned interactive learning through non-linear processes from kindergarten to year 6. An Aboriginal community member and a non-Aboriginal science teacher provided interesting sessions with teachers and students. This involved learning about various bush tucker plants through fieldwork in the garden and learning about Aboriginal and Western botanical science concepts. Alongside of this involved learning about what plants to look for and which plants were edible in the natural environment (Turner et al., 2017). The Aboriginal Elder engaged the students through narrative and use of metaphors about the garden site. Learning involved being place-responsive and understanding the importance of sustainable environmental practice. For example, the students’ learning about Aboriginal lore before entering the garden involved wearing red headbands. The headbands signified ‘respect for yourself and your environment’ and connected the students as a cohesive group of learners. The students collated reflective annotations about Aboriginal perspectives and visual information into a nature journal. A student from each group gave an oral recount about what they had learnt (Turner et al., 2017).

Methods

The structure of this study drew on Lewin’s (1946) Educational Action Research paradigm that aimed to improve teaching knowledge and practice through intergroup relations between the school and the local Aboriginal community. The Action Research process involved a series of planning, action and fact-finding about the result of the action (Bargal, 2008). Accordingly, the process of data collection was used to determine goals and assessment of the workshop results and integrated teaching program activities (Turner et al., 2017).

The two interventions that formed the context of the study’s data gathering, analysis, data classification and participant engagement strategies involved first, a 1-day workshop as professional development for the five participating teachers, teacher aides and the (acting) principal and second, the implementation of an integrated studies program over one school term for the teachers and students. The study’s data collection utilised a mixed methods approach. The use of quantitative and qualitative data collection methods allowed for the social/human factors to be explained in a more holistic manner (Creswell, 2003). Given the small cohort for this study, the paper-based questionnaire responses were entered into a password-protected ‘Excel’ spreadsheet file. The pre-test baseline data and the post-test data aimed to identify thematic patterns between (1) teacher knowledge and perceived self-efficacy in teaching Aboriginal culture, historical perspectives and knowledge systems and (2) common perceptions, similarities and/or differences in values or attitudes (Turner et al., 2017).

The research received approval and was conducted in accordance with the university Human Research Ethics Committee, the NSW State Education Research Process and Aboriginal research protocols to recognise, respect and incorporate local Aboriginal community members and knowledges (Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) 2012). As non-Aboriginal researchers (one with Māori heritage), we were aware of the legacy of research that has denied Australian Aboriginal perspectives (Martin, 2008; Smith, 2012), and as educators, we were guided by Nakata (2007) and Yunkaporta and Kirby (2011) on navigating the tensions around the teaching and the place of Aboriginal and Torres Strait Islander knowledges and perspectives within education in Australia (Turner et al., 2017).

Findings

Five female teaching staff participated in the project. Two teachers were early career teachers (20–29 years old with 1–4 years teaching experience) while three teachers aged between 30 and 49 years had 5 years or more teaching experience, two across national and international schooling contexts. All teachers were primary education trained. There was a significant difference on ‘experiences’ between early career teachers and teachers with 5 or more years teaching experience. One teacher expressed concern of the disparity between ‘the white people’s way of teaching and their own indigenous way of teaching and learning through their own language’ *in the Northern Territory, while in NSW less learning was obtained through school but more through personal connections with local Gumbaynggirr people (2606a)*. On the other hand, teacher 2606c, originally from South Australia (with teaching experience in New Zealand) and teacher 2606d commented Māori language and customs were deeply embedded in New Zealand curriculum yet expressed an awareness of less integration of Australian Aboriginal knowledges in NSW and in the NSW school system. The difference in curriculum approach between these two countries is largely due to the embedding of the New Zealand Treaty of Waitangi principles as a framework to bridge the gap between the literal differences between the Māori and English texts (New Zealand Ministry of Education n.d.). It could be argued Australia is yet to realise the rich opportunities the ATSI culture would bring into curriculum.

The teacher was surprised at the lower level of integration, suggesting difficulties in teaching Aboriginal knowledges in NSW schools and indicating the need for more professional development and support (Turner et al., 2017).

Changes in Teacher Confidence/Self Efficacy Related to Knowledge, Competencies, Attitudes and Skills:

The research questions sought to identify the ways in which schools and teachers enrich learning on local Aboriginal narratives and create spaces for and develop with Elders and the community. Accordingly, questions surrounding knowledge, competencies, attitudes and skills sought to identify what teachers felt they needed to learn in relation to teaching Aboriginal understandings and perspectives (native plant uses and benefits, histories and culture). The following highlights a selection of responses.

Figure 20.1, Question 2.1 displays a slight increase in the teachers' familiarity of local history, stories, customs and ways of life of Aboriginal people in the local area: from 3 agree, 1 uncertain and 1 strongly disagree to 4 agree and 1 disagree.

On the other hand, there was a reduction in teachers' confidence in their understanding of Aboriginal pedagogies and ways of learning for Question 2.2 (Fig. 20.1). This may have been due to the greater exposure to Aboriginal pedagogies during the activities and teachers may have realised they understand less and therefore have more to learn: from 2 strongly agree, 2 agree and 1 uncertain to 4 agree and 1 uncertain.

Figure 20.1, Question 2.3 shows the teachers expressed greater familiarity with the Aboriginal and Torres Strait Islander cross-curriculum perspectives framework in the Australian Curriculum as a result of the research activities: from 1 agree, 3 uncertain and 1disagree to 4 agree and 1 disagree.

Figure 20.2, Question 2.4 indicates a slight reduction in the teachers' views on access to relevant Aboriginal resources in the school. This may be due to having greater exposure to and learning about Aboriginal knowledge and histories from the Elders during the integrated program activities; therefore, the teachers may have realised the school resources they were aware of were less relevant: from 2 agree, 2 uncertain and 1 strongly disagree to 2 agree, 1 uncertain and 2 strongly disagree.

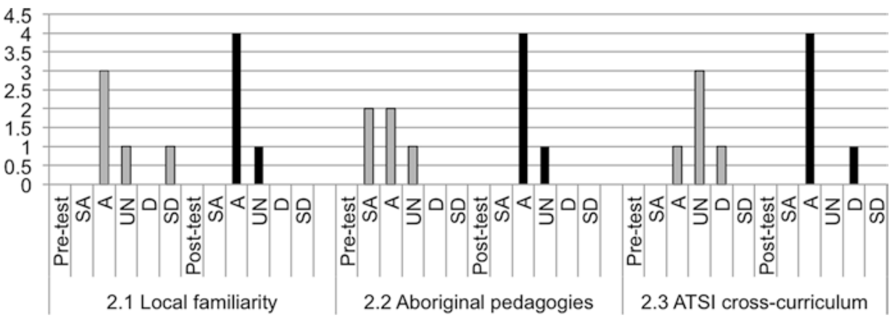

Fig. 20.1 Pre- and post-intervention teacher perceptions of familiarity with cross-curriculum priorities

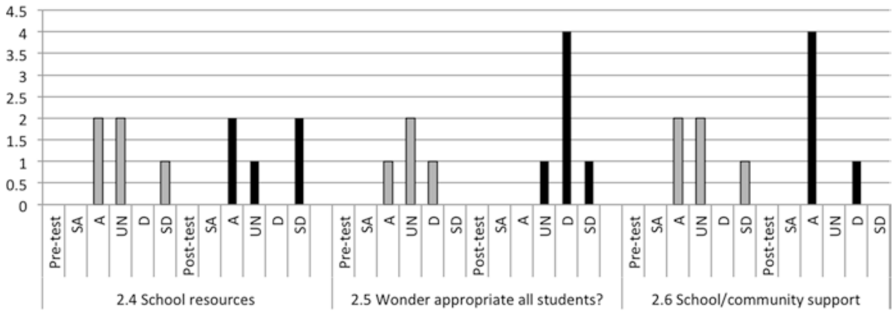

Fig. 20.2 Pre- and post-teacher perceptions of access to appropriate resources and school community knowledge

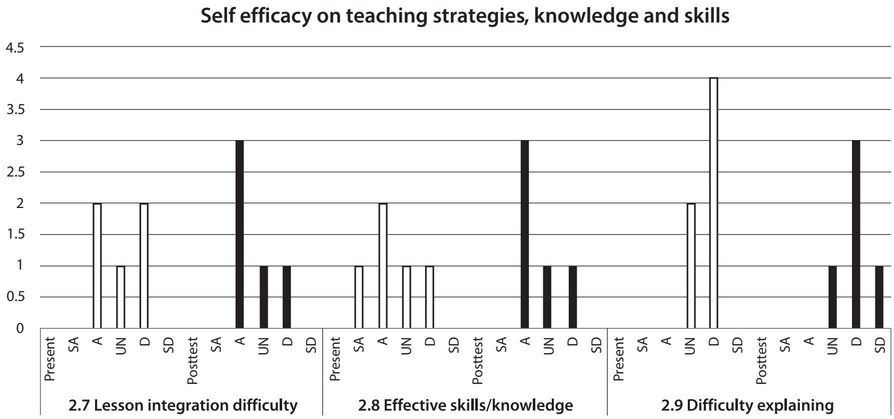

Fig. 20.3 Pre- and post-teacher perceptions of skills and knowledge for integrating and teaching Aboriginal content

Figure 20.2, Question 2.5 suggests the teachers felt Aboriginal knowledge and perspectives were not appropriate for all students in the school. This may be due to a heightened awareness after the integrated program activities where teachers may have perceived a greater need for Aboriginal students to spend quality time with the Elders as a rite of passage for learning within their cultural gender groupings: from 1 agree, 2 uncertain, 1 disagree and 1 strongly disagree to 1 uncertain and 4 disagree.

Figure 20.2, Question 2.6 displays an increase in school and community support following the integrated program activities that included learning with and from Aboriginal community members and the school's support for the research: from 2 agree, 2 uncertain and 1 strongly disagree to 4 agree and 1 disagree.

Figure 20.3, Question 2.7 suggests teachers felt they had difficulty integrating Aboriginal knowledges and perspectives into lessons. This may reflect some teachers' perceptions of the difficulties of fitting an Aboriginal Elder into lesson structures and the need to meet curriculum learning outcomes: from 2 agree, 1 uncertain and 2 disagree to 3 agree, 1 uncertain and 1 disagree.

Fig. 20.3, Question 2.8 displays a slight improvement in how teachers perceived their skills and knowledge for effective teaching on native bush tucker: from 1 strongly agree, 2 agree, 1 uncertain and 1 disagree to 3 agree, 1 uncertain and 1 disagree.

Additionally, Question 2.9 in Fig. 20.3 shows a slight improvement in their explaining the relevance of Aboriginal knowledge and perspectives to students: from 4 disagree and 1 uncertain to 3 disagree, 1 strongly disagree and 1 uncertain.

Discussion of Findings

In this section, teacher changes that occurred as a result of the project collaboration are discussed. In particular, teacher understandings on Aboriginal perspectives and their motivation and self-perceived capacity to incorporate these factors into their teaching were presented.

Teacher reflections imply a 'silo' pedagogy approach towards teaching Aboriginal perspectives from the syllabus due to the lack of professional development offered through the NSW Department of Education and Communities. This appears to have impacted on developing a sequenced, cohesive teaching program across the school. For this reason, the teachers valued the important influence the Gumbaynggirr Elders had 'for and with' sustained student learning. Moreover, some teachers felt the curriculum does not provide an educative space for Aboriginal Elders to work in collaboration with teachers and students. Additionally, a disjuncture between two styles of pedagogy was identified.

The teachers discussed their views of Australian Aboriginal understanding expressed in the NSW curriculum and found limitations in the support and understanding that they receive from the Department of Education and Communities. The lack of guidance and support for teachers in interpreting the curriculum requirements and incorporating Australian Aboriginal perspectives is recognised with strategies provided by some Indigenous academics (Kerwin & Van Issum, 2011; Nakata, 2011; Rigney, 2011).

> l think there are some really great things happening with the Australian Curriculum that are I guess really good for the Aboriginal perspectives and bring those in and I think that the curriculum is providing lots of opportunities for that. I still don't think there are the resources there to support that at the moment though and that's making it quite difficult for teachers to do it effectively (2606c).

> I definitely think it [Indigenous knowledges] should be part of it [curriculum]. It's about people power though. If we could have an Indigenous teachers' aid here all the time that we could do things for. Something like that would be perfect. It's almost like trying to teach Japanese without knowing it (2606e).

The changes in the teachers' cultural literacies pertinent to knowledge following the workshop and interventions focused on learning local knowledge, histories, customs and bush tucker nutrition and medicinal food sources.

> A lot more focused on the local history and the local custom or traditional stories and I've really appreciated learning about my local area and the students learning as well about their local traditions and stories behind certain land marks, the beaches and headlands and plant types, sources, recipes and cooking applications (2606a).

Another teacher spoke of the value of learning Aboriginal knowledge in science and pedagogies. This expands into a discussion of Aboriginal pedagogies.

> Almost a real Aboriginal way of knowing that they are coming back to nature and seeing things from a starting point, and being outdoors was really great too. As a lot of what we do is inside the classroom. So it has given them appreciation, I guess, that this is all around them, which sometimes they took for granted (2606d).

Several teachers referred to the eight Aboriginal ways of learning, an Aboriginal pedagogy developed for and introduced into NSW schools (8 Aboriginal Ways of Learning, 2011). Some felt it could be used with all students (as intended by the program), while others felt it related only to Australian Aboriginal students. Some teachers explained that because the classes were divided into small groups, they did not always have the opportunity to learn with the students, although they felt it was a good strategy to break into smaller groups.

> I believe handing down customs and traditions and taking it out of the classroom and out of the context of four walls and drawing stuff in the dirt and the sand and going around learning about bush tucker and taking it into an outdoor classroom environment. I think that is really valuable, especially as we have it at our fingertips (2606a).

The teachers' comments about teaching Aboriginal and Torres Strait Islander knowledges, histories and cultures reinforce their views before the workshop and programs, in that they feel more comfortable and effective when they can combine their teaching with the knowledge and pedagogy in unison with an Australian Aboriginal Elder.

> …it's really important because they are providing the authentic example or story about their culture and like I said nobody can do that better than they can. I think that that's really, really important but it also makes them feel like they have a place (2606c).

> I like the authenticity of actually having [Auntie] coming in. I like that connection and I like the story telling aspect of it when she comes in and that's the traditional way and how everyone sits down and listens to stories. Um, I always felt comfortable teaching the Aboriginal perspective anyway but I think this has more authenticity to it, doing it like this and having that actual person coming in with the knowledge and the history and the stories and yes, it just gives it more authenticity. I feel comfortable teaching Aboriginal perspectives (2606a).

Differences emerged in teachers' views of Aboriginal culture and knowledge as historical and dying out or 'lost' and as contemporary and ongoing. Some teachers were aware of the value and significance of ensuring the contemporary focus on Aboriginal culture is taught, particularly through Elders:

> … The red headbands were a great idea as well because it just made them feel they were all together… (2606b).

Some teachers spoke in detail of the students' increased local Aboriginal knowledge, bush tucker, medicinal plant knowledge and the value of the process of learning with both the science teacher and the Aboriginal Elder.

> As far as their traditional medicines and tuckers; a lot more advanced now to the point where they just go and start picking things and eating them; which with the knowledge that [Auntie] has taught them is really good. It coincided as well with the excursion where they were taken to down past the weir near the school. They did a tucker walk but they got more knowledge again to back up what [Auntie] had already told them. And it is amazing the more they looked the more species that they were finding and realising they had some of these in their own school grounds (2606a).

One teacher observed that students were very embracing of new ways and new knowledge:

> They have loved it. They have been really happy and proud to put on their red headbands and feel that they are making the connection with the earth and their environment and were very curious. I think that is the beauty of the younger students. They seek out knowledge as much as they can. So they ask lots of really terrific questions and take things on board, which has been good (2606c).

The teachers discussed that botanical plants and the incorporation of Australian Aboriginal sources of knowledge into learning a curriculum predominantly focused on Western science.

> What I have found with my class now it's given that awareness to actually see the species of plants that are there so they have learnt about the species and the applications they can have in medicine and it's all native stuff, not just…They were genuinely really into it. It is really exciting (2606a).

> If they are able to mesh the two together. I think it is really important, especially for me because when the Aboriginal Elder was here at the beginning of the professional development thing that he did, I just thought it was really interesting how Aboriginal people had survived for so long using bush tucker and then we come in and we need all these medicines… (2606c).

> But I think that they have found it quite interesting that there are things you can take from the bush and use… But I think that we still probably have a long way to cement it in their [students'] heads about what is ok to eat and what is not ok to eat in the bush (2606c).

> And I think there is nothing worse than being stuck in a classroom and not being able to get outside. So I guess it happens just by coincidence a lot of the time, I guess it's because we are so used to doing it but the 8 ways of knowing is what we are really trying to imbed in all of our teaching practice (2606d).

The teachers' views on the value and place of Aboriginal knowledges and histories in the school curriculum strengthened after the workshop and program, especially in relation to local knowledge and histories.

> …it's important to have an awareness of the traditional owners and custodians of this land, this country, especially in this school because we have that connectedness with this part of the bush as well…I think they [the students] have appreciated that fact, as well looking at the topography of their school in relation to the houses and part of the bush and they have taken a bit more ownership of that (2606a).

> They'll [the students] tell you about sarsaparilla. They'll tell you about the health benefits of having it…They know how to identify it in the garden so it's a really nice back to nature understanding for them. It's hands on whereas a lot of the other sciences we do…they don't relate to it the same way because it's in a book…they'll take their parents and say 'this is a sarsaparilla plant and we have tasted it and we have all these things in our gardens'. I think it's really nice. It's a real hands on which is a real aboriginal pedagogy, a way of knowing (2606d).

In relation to the place and benefit of teaching and learning Australian Aboriginal knowledges within Western curriculum, such as standard science or mathematics, the teachers identified the value of students learning knowledge and properties of plants for bush tucker and medicinal uses as an ecological literacy. Engaging the students in nature and science through direct learning experiences evidenced successful learning outcomes. Changes in the teachers' knowledge following the workshop and interventions focused on learning local knowledge, histories, customs and the bush tucker knowledge.

> The bush tucker natural medicine. We are living in Australia and we are surrounded by the remedies and things in the bush and on the trees and I think if western science could tap into that it would just be a beautiful Australian way of health, well being, people learning about what we could get out of the bush and what remedies they could use would be excellent and I think if western science embraced that it would be much more valuable, just society in general (2606b).

The teachers' comments on professional development have moved from the pre-workshop interview to a more specific focus on the importance of learning and sharing more local knowledge and the need for local Aboriginal input and selection of material and content for authentic lessons:

> I like going on excursions to the actual sites where the stories are told. I think that's got a real reverence and it's just amazing, it's spine tingling kind of… You have the person with the knowledge, sitting down in the shade of the tree at the spot where the story is and the stories are long… keeping that bush tucker garden while grazing on Lilly Pilly berries (2606a).

> The kids feel they have ownership of the garden now they did not have before, they know where their plants are, they are watering them. So there has been a big positive in that aspect because they are realising that the garden is edible and so this new concept came into the lesson about our food supply, eating seasonally (2606e).

> …positive I think and the red headband idea has been working well. We have all got our class headbands. They migrated from their heads to their wrists, so that is fine … It symbolises that when you put the headband on that you are going to show respect for yourself and your environment (2606a).

> I think it is completely different to what we can do. They can walk them around and it's that real verbal knowledge, which I could stand there and talk all day and half of them wouldn't listen. But if they are actuality out and touching the earth and walking around like that, I think that is really valuable (2606e).

The teaching of food technology and design literacies through manual drawing of botanical elements such as plant and tree leaves was presented using a process whereby the instructor filmed and projected the botanical drawing live in order for all students to see and follow the process. This was new to the teachers and impressed both teachers and students. The teachers observed that this enhanced the students' drawing skills; helped them learn about plant structure, science and mathematics; and expanded their ideas of artistic expression, which gave confidence to students. They reflected that the value of students understanding the botanical drawing process was about analysing an object and transferring their observations and understanding to an actual design of the object. This is not necessarily an interpretive process but one of identification and evidence and to which students responded well. Teachers commented on the students learning that scientific drawing is more than being artistic but about being accurate and using drawing to identify species and drawing shapes, hands-on activities, interaction with the outside bush and having fun:

> I guess before, it was just about shape and things. Whereas now I know it's about understanding plant anatomy, which I found fascinating, so it certainly has improved…. Yes, I would be confident doing this method of demonstration with the children now, definitely (2606d).

> It helps them to identify species. It is not just about the artistic pursuit of drawing it is also about just getting the evidence down on paper…It's really interesting how they can see the differences now I think from botanical drawings as well. They probably didn't realise it at the time but looking back it's really given them that more acute awareness of how plants actually formed (2606a).

More broadly, the teachers discussed the transferrable skills students are able to learn from botanical drawing and the different levels of knowledge and application through the primary years: documenting actual growing plants, learning about the plant properties and writing recipes and reflections on taste testing.

> I don't know if I have ever considered botanical drawing within the curriculum for 'kindy' before. But just to develop that knowledge of shapes. I keep going back to that but you know, it was what was really significant for them. So developing and seeing shapes out in nature was really good (2606d).

> It's more in science. I wouldn't say it's a major thing as far as the whole curriculum goes but it was nice for our school to have the opportunity to go over to the bush and it was very relevant that we were drawing the actual species that we had been studying and planting and going to plant and there was already existing species of the trees there before planting the new ones (2606a).

> … And you can tie that in with the literacy, which we did. We had lots of books about trees growing and different areas. So I think we had about 5 different stories that we used over the time about plants and growing…(2606d).

Some teachers noted the desire to expand the 'seed to feed' learning to include a kitchen activity:

> It would be great to have a kitchen like they have in secondary schools where we can cook food made from what we pick from the garden…the students loved taste testing the Quandong Muffins. The connection to food science for the older students was really interesting and something I feel confident in teaching myself (2606a).

> …all these years I never knew you could grind wattle seeds from the Wattle tree and use them in recipes. If only we had a kitchen the kids could have access to (2606e).

Some teachers spoke of the importance of integrating the cross-curriculum perspectives:

> They have loved the nature journaling and it's been terrific because if it can be a unit, it fits into so many of the key learning areas so it's been really, really good; being so proud of making their journals and fitting into maths, literacy, science, food technology, HSIE (2606d).

> The passing of knowledge through storytelling by an Elder was a nice finish to the program, thank you (2606a).

Limitations

The study included one primary school and five teachers and for this reason should not be reflective of all school populations. The researchers recognise there is also a measure of subjectivity concerned within the synthesis of findings that will influence external validity due to the small sample size. However, the findings propose a growth in teacher expertise, self-efficacy and advancement of Aboriginal content, pedagogy and curriculum after the workshop and the integrated whole school program. Regardless of the controlled sample size, the study evidenced that teachers had developed a more positive and focused attitude to the ways in which Aboriginal content can be delivered in collaboration with Elders. Above all, the project highlights the optimistic effect of practically based curriculum interventions.

Conclusion

The research delivered several robust messages that acknowledged the known value of local Aboriginal pedagogies in relation to teaching Aboriginal and non-Aboriginal students on culture and customs. The value of incorporating regional knowledge and human agency as a resource cannot be underestimated. Nevertheless, for teachers, the uptake of those things into their teaching practices is complex, and so they require the right support in terms of resourcing and professional development to further increase their skills and knowledge with regard to working with Elders.

While resources integrating Aboriginal and Torres Strait Islander knowledges and belief systems may exist, teachers need leadership in utilising them. The most compelling data from this project highlighted the importance of working with local community members to embed local Aboriginal knowledges and pedagogies through a collaborative teaching approach (Harrison & Greenfield, 2011; Nakata, 2011; Yunkaporta & Kirby, 2011). Ideally, this ought to be an ongoing task, as recognised by teachers indicating they have struggled with how to integrate Aboriginal and Torres Strait Islander cross-curriculum perspectives into their lesson plans, classrooms and teaching programmes. Even though the curriculum emphasises the need for such participation by local Elders, this process involves building relationships and connections first.

In the context of this small project, the connections developed between the university researchers and Aboriginal Elders have demonstrated to be effective in relationship-building with the school community. Through this project, teachers came to recognise the significance and pride in developing connections with local Aboriginal people and knowledge and how this can inform their teaching. Successful integration requires guidance, planning and the development of teaching programs adapted to the local knowledge and environment.

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Chapter 21
A Synoptic View of Sections 1, 2 and 3

Marion Rutland and Angela Turner

Abstract This book has been designed to be of relevance to teachers in post, teacher trainers, pre-service teachers, curriculum developers, CPD providers, educational researchers and educational policy makers. The structure of this book contains acknowledged experts in the fields of food education and contributing chapters supported as far as possible by evidence from actual experiences and research. The target audience are teachers, trainee teachers, and teacher educators but will also be relevant to educational policy makers, researchers and potential researchers.

Keywords Food education · Primary and secondary curriculum · Food teaching Teachers' professional identity · Contemporary issues

Part 1: Food Teaching in Primary and Secondary Schools in Different Cultures

This part explores a range of curriculum approaches in primary and secondary food education in England, Ireland, New Zealand, Australia and Malta.

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Chapter 2: Exploring Food Education in the English Primary Curriculum, Sue Miles-Pearson

In this chapter the author's aim was to gain an overview and better understanding of changes that had occurred in primary school food teaching in England from 2009 to 2018 based on the views of undergraduate and postgraduate students in initial teacher education (ITE) and schools. The research in 2008 indicated a strong belief that when teaching food to primary school children, they would benefit from a strong association with science. However, a key finding in the results in 2018 pointed to a stronger emphasis on teaching food across a wider range of the curriculum disciplines. Despite requirements in the recent revised National Curriculum and advice from a range of organisations, there had been a decrease in the teaching of basic cooking skills, food preparation and promoting and applying nutrition. However, to compensate this, there was an increase of extracurricular sessions such as after-school cooking clubs, cooking breakfasts, foods grown and eaten during war time rationing, community Christmas parties and residential experiences and pupils growing their own fruit and vegetables. It can be argued that this is a direct result of the recent dominant focus of literacy and numeracy in the formal curriculum in English primary schools and reflect considerable creativity and resourcefulness by the teachers and schools to include food education.

Chapter 3: Reducing Challenging Behaviour and Maintaining Aboriginal and Torres Strait Islander (ATSI) and non ATSI Student Retention Through Food and Exercise in Primary Schools in New South Wales, Australia, Gillian Stuart and Angela Turner

This chapter reflects on research projects and initiatives undertaken during Gillian's 40-year career as a classroom teacher, head teacher, regional educational consultant, teaching principal and principal. It focuses on indigenous knowledge at the cultural interface between Aboriginal and non-Aboriginal cultures and cross-cultural multidisciplinary teaching and learning contexts in primary schools in New South Wales, Australia. The purpose was to promote health-based education programmes that engaged and supported positive student outcomes, through breakfast and lunch programmes and morning exercise routines.

Through the 'Gumbaynggirr Pathway to Learning' project and in partnership with Southern Cross University, relationships were forged to foster a greater understanding of local indigenous culture, historical perspectives and indigenous knowledge systems. This project was significant because it facilitated the embedding of indigenous perspectives in a culturally responsive, integrated and cross-curriculum manner. The chapter argues that enriched learning environments supported through physical activities and food applications are by far the most salient influences to improve intellectual learning outcomes, physical dexterity and emotional strength and resilience in students in schools.

Chapter 4: What Is the Current State of Play for Food Education in English Secondary Schools? Ruth Seabrook and Vanessa Grafham

Secondary school food teachers in England have recently faced a period of unprecedented change, with fundamental changes to the National Curriculum (NC) for design and technology (D&T) and for food technology. These changes are in the context of the current government's new school accountability measures and the privileging of academic subjects in the curriculum through the introduction of the English Baccalaureate. This chapter explored 'the current state of teaching food' in secondary schools in England and reviewed research findings based on case studies provided by a range of food teachers in secondary schools.

Initially, it might appear that there is little to be satisfied with secondary food education in England and that the subject is suffering both a crisis of confidence and more importantly existence. There is currently limited choice for those students wishing to take a food examination at 14–16 years, although the numbers taking the subject are buoyant. However, with so many charitable organisations, dedicated teachers and pupils wanting to study food, the outlook remains positive and the increased emphasis on food science is encouraging. However, the loss of an examination for pupils aged 16–18 years to provide progression into higher education is a major issue that needs addressing.

Chapter 5: A Technological Approach to Secondary Food Education in New Zealand, Wendy Slatter

In this chapter, Wendy examines the issue of secondary food education in New Zealand, reviewing the past and exploring the current situation. Recent curriculum developments in New Zealand locate food education within two learning areas, with different underpinning learning theories, structure and focus. Food lessons are no longer about teaching cookery skill and housewifery. The *Health and Physical Education* curriculum scaffolds learning in food and nutrition by exploring factors of influence that affect the well-being of individuals, families and communities. The practical components include selecting, preparing, cooking and serving food. Students are also engaged with health promotion within their school and/or local community. On the other hand, the *Technology* curriculum bases *food* technology within a sociocultural learning theory perspective, where learners explore authentic issues that aim to be practical and transformative to the situation and the people concerned. Students then develop material and ingredient knowledge to formulate food products that meet the needs of this specific audience.

A theoretical model presents food as a *technological outcome,* with specific reference to what components of food could be taught to students at junior secondary level (12–14 years). The intention is to provide teachers with ideas on how to take subject knowledge and conceptualise it as learning opportunities with their students. Teaching 'food literacy' reflects a deeper pedagogy than just teachers teaching cookery skill. The intention is to develop New Zealand school food education programmes to help guide teacher decisions about the concepts, context, content and focus for food technology programmes of learning.

Chapter 6: Developments in Secondary Food Education in England Since the 1970s: A Personal Perspective, Angela J. Turner

The chapter explores Angela's personal perspectives of food education in English schools and how it has evolved from domestic science in the 1970s to being part of design and technology (D&T) in the National Curriculum. More recent trends identified that the subject has been taken out of D&T and the introduction of General Certificate of Secondary Education (GCSE) Food Preparation and Nutrition for pupils aged 14–16 years. It is her personal tale, drawing on experiences as a pupil, as a graduate in the food industry and as a teacher working in and around London for more than 25 years.

Angela's belief is that food is so intrinsically woven into our culture and our daily lives that we cannot consign it to 'just another school subject' but should elevate its standing in school, where we are taught the basics in a way that helps us to understand the world around us and to have healthy relationships with the food we eat. This education should not be left to celebrity chefs, as they enhance the basic school curriculum but should not replace it.

To teach children how food is grown, how it is processed and cooked and the nutritional aspects of how it affects our bodies is a key element in a good education system, because it's about understanding concepts that are integral to our well-being and we need to promote healthy lifestyles in childhood so that the future adult population is less prone to disease and illness. The world's population is increasing, and we need to provide for that with healthy and readily available food which is produced efficiently but showing good welfare for all involved. A good education in food should be high profile and valued for its contribution to a healthy society and to a well-educated workforce. Angela concludes by asking if we have achieved this ideal or if we still have issues to address in secondary schools in England.

Chapter 7: Food and Nutrition Education in Malta: A Journey Across Time and Subject Boundaries, Suzanne Piscopo

Suzanne presents a historical overview of how food and nutrition education evolved in Malta, looking at its original goals of life skills, health improvement and potential employment. It offers a detailed description of the current provision of food and nutrition education in secondary schools highlighting the prominent role of the traditional subject of Home Economics and the contribution of other subjects such as biology, physical education, personal, social and career development, core science and, more recently, the vocational subjects of hospitality, health and social care and agribusiness.

The chapter then focuses on recent developments for food education based on the Mediterranean diet framework as a context for food and nutrition education. This would be within four dimensions of sustainable development: *health, environment, economic and social-cultural*. Suzanne sees a Mediterranean diet framework as a unifying vehicle for personal life skills, responsible citizenship and future employment. The ultimate goal is the enhancement of well-being and quality of life of Maltese food consumers and producers, Maltese citizens and visitors to the islands to replicate the realities and complexities of the world beyond the school walls.

Chapter 8: Home Economics Education in Secondary School Settings: Lessons from Education Policy on the Island of Ireland, Amanda McCloat and Martin Caraher

The teaching of Home Economics in secondary school education is discussed in two jurisdictions on the Island of Ireland—the Republic of Ireland (ROI) and Northern Ireland (NI) in the UK. The educational rationale, aims and underlying pedagogical approaches to teaching Home Economics in educational policy are explored and comparative case study similarities and differences highlighted.

The pedagogical approach utilised in Home Economics education in both the ROI and NI facilitates the subject to play a key role in developing practical and theoretical food competencies in young people. The application of scientific and theoretical knowledge, understanding and skills in practical real-life food situations is an inherent pedagogical approach to teaching and learning in Home Economics and aims to facilitate students to have a positive relationship with food. It is a comprehensive and wide-ranging programme incorporating scientific theory, nutritional knowledge and practical food and cooking skills taught in an experiential, sequential and integrated approach.

Home Economics is a well-established subject on the island of Ireland which is well regarded as a compulsory subject on the Northern curriculum and a policy recommendation now in place to make it compulsory in the Republic of Ireland. The pedagogical approaches and philosophical underpinning in the Home

Economics curricula on the island ensures that the subject is ideally placed to deliver a holistic, multifaceted and comprehensive food education to students aiming to prepare them to navigate everyday food circumstances and develop a sustainable healthy approach to, and relationship with, food.

Part 2: The Professional Identity of Food Teachers

This part looks at the influences in schools, higher education, initial teacher education, continuing professional development (CPD) and vocational programmes on the identity of food teachers in different contexts and cultures.

Chapter 9: Positive Ingredients to Redefine Food Education in Australian Schools, Donna Owen

This chapter embodied the notion that the way in which food education is taught in schools is dependent on how teachers interpret the curriculum. By the same token, teacher identity is an important factor when determining the impact on student interest and achievement and how this can frame student perceptions on what they are learning. For example, some teachers are influenced by how food was taught in the past and continue to replicate the same content to the next generation of students. This approach envelops a protective, 'comfort zone' style of teaching and offers little more than a mechanism to develop practical skills and nutrition knowledge only.

While these are essential life skills worthy of learning, it is critical to ensure students are also exposed to current issues and problems relating to food security and sustainability at local, national and global levels. For this reason, teachers are required to continually evolve and widen their knowledge through professional learning and to adopt a flexible mind set as a way to achieve professional growth throughout all stages of their career. This responsiveness is an expectation from education stakeholders in relation to the new content in the Australian Curriculum: *Technologies* (*Food and Fibre*). The discussion put forward in this chapter drew on a survey undertaken by 20 teachers as a measure to identify key influencing factors that will keep food education evolving and germane for students. In summary, the influencing factors involve teachers to be flexible and open to curriculum changes, engage in reflective practice, regularly question routine practices, and to nurture students to be 'agents of change' in relation to food sustainability. Thus, teacher agency becomes the strongest form of advocacy to campaign a 'futures thinking' approach to the subject. This is imperative to ensure food education remains current and relevant to students, particularly for those who seek a career as a food educator, so they too become agents of change for the future generations of students they may teach.

Chapter 10: Where Will Future Secondary Food Teachers Come from in England? Sue Wood-Griffiths and Suzanne Lawson

It is important to understand the historical influences on food curriculum over time in relation to societal, educative and economic need in order to understand what the status of the subject ought to be in a more contemporary setting. For the subject to have 'status', it should command to meet the requirements of both the food industry and school industry settings. However, food education in English schools appears to lack academic credibility due to the removal of key subjects that were influential in offering a pathway into university study as a food technologist or nutritionist and other related jobs to the food industry. This chapter examined the unintended consequences and potential impact of the most recent changes to the English curriculum and qualifications framework. The chapter reveals pathway progression into food science and technology-related degrees is often not clear via science and mathematics subjects, nor available via food education courses. The linchpin this chapter raises is the need for quality teacher training in food science and technology knowledge and skills. The ideas put forward in this chapter describe how teachers might be trained to meet these industry and education needs.

Chapter 11: Changing the Professional Identity of Food Technology Teachers in New South Wales, Australia, Deborah Trevallion

The research put forward in this chapter drew on a framework that was developed from multiple case studies that explore changing behaviours, perspectives, feelings and experiences of preservice students. It is important to realise that many preservice food education students are vulnerable to 'identity change' when they transfer from an industry-based career into a school teaching context. One of the reasons for this is that when students come to Initial Teacher Education (ITE) courses, many come with a significant amount of prior knowledge, skills and experience from occupations that they feel are transferable to the subject area they seek to teach. However, each have a different life history, a different background and life experiences. Some will have backgrounds in cooking, catering, home science, Home Economics and fast-food businesses. However, many struggle to uptake new knowledge and as a result find it difficult to move on from existing values and beliefs, i.e. skills that require a didactic, lockstep, master-and-apprentice approach compared to a critical design-thinking and project-based learning approach. This is where facing change can be confronting and feelings of 'identity' loss may occur. To prevent this from occurring, preservice food technology education teachers need to embrace change and reconcile internal conflicts in order to evolve their professional identity. Tension and resistance are unpacked in this chapter with regard to identity transition and the ways in which framing identity has been included in a foundation course in a higher education ITE undergraduate degree. The study showed that in order to promote a change in professional identity and a willingness to accept and promote curriculum and new ways of thinking, change must be accompanied with university coursework.

Chapter 12: Qualifications for Working in the Food Industry: Understanding All the Available Options for Students and Educators in Victoria, Australia, Bronwyn Graham

Food education at secondary school level has undergone significant changes in recent years in Victoria, Australia. In this chapter, the role of the food technology teacher is discussed and how food technology school syllabi and non-specific food subjects are taught in the junior years (i.e. levels below years 11 and 12). Careers within the food industries were examined and entry requirements explained across a variety of career pathways. There are various settings where study can occur in relation to the food industries. For example, within the school setting, this involves undertaking certain tertiary training modules through the vocational education and training (VET) in schools program. This learning approach acts as a bridging course and entry pathway into a course-specific Technical and Further Education (TAFE) program. Post-school offers a variety of entry points into food-based careers. These range from first achieving an Australian Tertiary Admission Rank (ATAR) for university entry (higher education) or entry into TAFE (vocational education and training) that accepts prior learning. While the VET sector is a largely misunderstood study option, it offers very relevant job opportunities for students who seek a career in the diversity of the food industries (craft brewer, food lawyer, mycologist, molecular gastronomist, food packers, food engineers, food reporters, food stylists, just to name a few). While the role of a careers advisor is to suggest employment pathways post school and the type of post-school education and training that would be required for a student to study, ultimately it is the teacher who is often the first point of contact with regard to helping students to identify a future career path, particularly if a student shows a desire to work with food.

Chapter 13: Continuing Professional Development for Australian Secondary Food Technology Teachers, Carly Saunders

Ongoing professional development is a requirement in any career to ensure there is a continuum of new knowledge and skills learnt; that in turn equips people with a range of strategies to be more effective and relevant in their workplace. Hence the recently established New South Wales Education Standards Authority (NESA) has mandated that all primary and secondary school teachers engage in compulsory professional learning courses in order to enhance their teaching currency through developing core attributes that aim to enrich their knowledge and skills. It is also a mandatory requirement to be able to maintain their teaching registration number. Carly founded The Happiness Mission® in 2016, a NESA-endorsed provider for teacher professional learning. In this chapter, the process of accreditation details what is involved in achieving this status and the measures that are undertaken to retain it. Feedback through data collection is an integral component to retain this status which is an ongoing process. The value of feedback is critical as much as it is essential, because not only do The Happiness Mission® team learn a lot about the needs of the teachers, a community of learners has been built as a result. A social media forum also provides resource sharing, strategies and questions as an ongoing enterprise.

The data presented in this chapter is significant as it details teacher stress in relation to examination success for students and ultimate responsibility for students' futures if not taught effectively. This is compounded with parental pressure to ensure students excel under examination stress but more importantly the steady decline in student enrolments for the Food Technology Stage 6 course across NSW schools that links back to the examination component of this course. By far the most significant influencing factor in schools is the quality of the teacher. Therefore continual professional learning is essential to support the teacher and provide them with the necessary tools for successful teaching and learning outcomes.

Chapter 14: Food Education in Upper English Schools: Progression into Food-Related Undergraduate Courses in Higher Education, Marion Rutland

The early beginnings of food education in England is a fascinating start point for this chapter as it provides a snapshot on the relationship between education, society and economic expectations during the mid-nineteenth century, and over time to our current contemporary setting. The consistent tension is evident between the academic scope of the subject and the non-academic offering for the less-able academic student. Key 'watershed' periods highlighted in this chapter (1970–1980; 1990; 2013–2018) describe various curriculum changes, the drivers that initiated these changes and research projects undertaken in schools. For example, during the 1970s the new syllabus titled Home Economics opened up the opportunity to offer science and psychology content. During this period, social change was dramatic, which enabled male students to study food at school. The subject was based on understanding the needs of the family and homelife, consumer awareness, nutrition and diet (a consistence theme over many decades). School-based examination courses were well established by this period, and undergraduate higher education degree courses emerged. However research projects, such as the Nuffield Home Economics project (1977), revealed that even though scientific, investigative approaches to food offered a central position where students could benefit from in order to understand personal health, many Home Economics teachers debunked this approach. While there was an opportunity to apply scientific and technological principles and concepts into food design product development when the new 1999 Design and Technology syllabus was implemented, the Home Economics teachers, who were expected to teach design and technology, remained confused and alienated as it placed the subject context outside of the home domain.

Fast forward to more contemporary times where major health issues started to emerge by 2013 even though the argument put forward by the Department for Education (DfE) that engaging students in cooking would ensure they would make healthy food choices. Nonetheless, the DfE continued to push for cooking and culinary skilling in schools, but reference to food science was eventually included in the Food Investigation Task, yet it was not required to be understood and assessed through the application of the technological processes involved in practical food preparation. With this in mind, food examination courses and university food-based undergraduate courses display a significant difference in content. Research undertaken in 2014 revealed that the current A-level food technology courses were considered insufficient preparation for university entrance and needed to be revised. The chapter proposes and discusses a new A level examination that may act as a pathway into university courses in relation to nutrition, dietetics, nursing, health-related professions, teaching and the food industry.

Part 3: Current Content and Contemporary Issues

This part explores current curriculum approaches in food education for the teaching of food skills and knowledge, food technology, nutrition and health, biotechnology, global food supplies and teaching food in the UK and New Zealand and indigenous cultures in South Africa and Australia.

Chapter 15: Current Research in Nutrition in the School Curriculum in England, Sue Reeves

Sue considers that good nutrition is fundamental for health and well-being, and given the increasing levels of obesity in the UK, it is important that food and nutrition are taught from a young age in the school curriculum. This must be grounded in evidence-based guidelines and research that considers current nutrition information and how nutrition knowledge can be applied. The curriculum should include the fundamentals of energy balance and nutrient requirements describe a balanced diet; consider public health, obesity and related co-morbidities; and consider food journeys from farm to fork, food safety and the application of nutrition knowledge. In addition, new areas for nutrition research such as the role of the gut microbiome in health and disease, sustainability and global food security should be embedded into the curriculum to ensure teaching is up to date.

Essentially, there is a need for investment in food and nutrition education to give pupils knowledge about healthy, safe and sustainable diets. New developments in nutrition research should inform the curriculum and help strengthen the teaching of food and nutrition in schools to give pupils the skills they need to make informed choices regarding food and diet that will protect their health and the health of their families in both the short and long term.

Chapter 16: A Curriculum Developer's Perspective on the Place of Food in the Secondary School in England, David Barlex

David explores the importance of food education in England from the government's perspective by highlighting its concern with regard to the nation's health and the impact of poor dietary choices on the cost of the National Health Service (NHS). He outlines the government responses to these issues including revisions to the National Curriculum and the inclusion within the design and technology programme of study of a section devoted to cooking and nutrition, the introduction of a new General Certificate of Secondary Education (GCSE) Food Preparation and Nutrition (aged 14–16 years) and loss of a food academic food qualification for pupils aged 16–18 years. He highlights that it is not just diet that contributes to well-being; physical activity, food choice, sustainability and food availability all play key roles and that the overall issue is much more complex.

David investigates what young people might need to be taught in order to be able to cook for themselves (now) and for their families (in the future) and where this might be in the school curriculum. He suggests that this may be as food technology within design and technology, or it might be better placed within the Personal, Social and Health and Economic (PSHE) curriculum with other aspects of food education in other subjects such as science and geography. Though it is acknowledged that this would need to be carefully coordinated by teachers and schools. Consideration would be needed of the facilities and ingredients required, the types of meals that pupils should be taught to cook and the influences that would shape their willingness and ability to cook for themselves. The role of science in learning how to cook is highlighted as a scientific understanding of the principles of cooking, the role of ingredients within the cooking process and the nutritional properties of ingredients are also needed. This would ensure that young people don't just follow a recipe but can make informed judgments on the choice, function and use of ingredients as a contribution to a healthy diet.

In conclusion, David explores the possible content of a food technology course based on the concept of technology as artefacts, knowledge, process and the properties of humans, all requiring discussion between science and food colleagues:

- Envisaging how things might be—all people in a particular community are well fed.
- Envisaging what is needed to achieve this—the community identifies the types and amounts of different foods that are needed.
- Creating this reality—members of the community cooperate in growing, harvesting, storing and distributing the food.

Chapter 17: Population Growth and Global Food Supplies, Christopher Ritson

Christopher argues there is substantial evidence to suggest that recent experiences of higher and more volatile international food prices has been caused by a change in the long-term balance between food supply and demand globally. Food is likely to remain relatively more expensive than it was 15 years ago, and international prices of food commodities are likely to continue to be volatile. With the world's population expected to grow by some 40% by the end of the century, a major global challenge confronts the world, if the nineteenth-century political economist Thomas Malthusian 'positive checks' are to be avoided.

However, in principle, many of the causes of this imbalance between increase in demand and growth in supply of food are reversible. Thus, with changing patterns of consumption (less meat, less waste, less biofuel) together with new yield increasing technologies, there can certainly be enough food globally to feed the world's population adequately throughout the twenty-first century. In part, higher prices may stimulate such a reversal, and belief in the merits of sustainable consumption may also contribute. But most important is probably the need for the political will to ensure that global inequality does not lead to a future as outlined by the English political economist Reverend Thomas Mathus.

Chapter 18: Socially Acute Questions: How Biotechnology Can Provide Context and Content for Discussion in Food Technology Education, Bev Francis

Biotechnology provides a rich source of socially acute questions that can be asked when considering the risks, moral issues and legitimacy of many biotechnological foods being labelled 'pure' and 'natural'. Bev identifies socially acute questions (SAQs) as 'open-ended questions that involve ill-structured problems that integrate knowledge in the humanities and sciences and are complex and raise uncertainties'. This broad perspective of exploring socially acute questions allows consideration to be given that range further than an established science, technology, engineering and mathematics (STEM) education. It focuses on the influences of civics, politics and the historical impact on people's views about such issues.

Bev explores the role of genetic education and biotechnology in food production, the dimensions of SAQs for food education, the risks and its effect on consumer acceptance, the identification of ethical and moral issues impacting on SAQs and how they can be used as a teaching context to broaden students' view of specific issues. A range of strategies are described that help students not only identify their viewpoints but also provide space to explore others' views. The most important pedagogical outcome when using SAQs as a focus for discussion is to make sure that students' views of the issue are broadened and ensure that students were aware of other perspectives and at least had a better understanding of their own views and the reasons for their strong opinions. Bev believes that there is a need for this discussion in food education so that innovation can be encouraged alongside an insightful and sensitive awareness of the issues involved.

Chapter 19: Teaching Food Technology in a Secondary Technology Education Classroom: Exploring Ideas in Indigenous Contexts, Mishack T. Gumbo

In this chapter, Mishack believes that indigenous knowledge pertaining to food is underrepresented in the technology education classroom, despite indigenous contexts being replete with the rich knowledge, skills and technology engaged in the production and processing of food. Teaching about indigenous food in the technology education classroom can enrich both indigenous and non-indigenous learners' learning, transform education and ensure food security and health and promote culture.

Mishack contents that community cultural wealth theory (CCWT), a tenet of critical race theory (CRT), is considered relevant to unearth the wealth of food knowledge that resides in indigenous contexts. CCWT favours the resurgence of indigenous knowledge against colonial practices which attempts to deny the same recognition it deserves. A collection of knowledge, skills, abilities and contacts possessed and used by indigenous communities from multiple sources such as storytelling, family histories, biographies, food, dress, technology, etc. can be better understood through CCWT.

Indigenous communities display the technological knowledge and skills of producing and processing food. Teaching through design is the core of technology education; therefore learners can be assigned design projects which combine indigenous processing technology with conventional technology. Care should be taken for conventional technology not to override indigenous technology. Apart from the maintenance of food security, sovereignty and culture, the chapter demonstrates that indigenous contexts are endowed with the rich knowledge, skills and technology pertaining to food harvest, processing and consumption.

Chapter 20: Learning Cultural, Ecological and Food Literacies Through the Gumbaynggirr Pathway of Knowledge Project, Angela Turner

Angela presents research from a project collaboration undertaken in New South Wales, Australia, between a rural primary school, local Aboriginal Gumbaynggirr elders and Southern Cross University. The research responded to an expressed school and community need for teacher professional development on local Aboriginal culture. The aim was to understand food values at the core of Australian native food and plant knowledge systems, coupled with developing transferable teaching strategies for the classroom. Exploring and understanding natural food sources were triangulated between Australian Aboriginal science and Western science, visualised through nature journaling.

The research methodology assigned three settings of engagement:

- The embedding of local Gumbaynggirr perspectives in curriculum delivery across years K-6 in an integrated, culturally sustaining and cross-curriculum manner (cultural literacies)
- The embedding of sustainability perspectives to better understand earth's natural systems and food supply sources (ecological literacies)
- The embedding of food technology and design applications, to enhance student learning on Australian native plants as a science, an art and a sustainable, healthy lifestyle (food technology and design literacies)

The project highlighted the importance of working with local community members to embed local Aboriginal knowledges and pedagogies through a collaborative teaching approach. This, Angela argues, should be an ongoing task, as teachers have indicated they have struggled with how to integrate Aboriginal and Torres Strait Islander cross-curriculum perspectives into their lesson plans, classrooms and teaching programmes. For such a curriculum approach to be a success, there is a need for participation by teachers with local elders to build relationships and connections.

The research acknowledges the known value of local Aboriginal pedagogies in relation to teaching Aboriginal and non-Aboriginal students on culture and customs. The value of incorporating regional knowledge and human agency as a resource is highlighted. However, while resources integrating Aboriginal and Torres Strait Islander knowledges and belief systems may exist, teachers need leadership in utilising them. Through this project, teachers came to recognise the significance and pride in developing connections with local Aboriginal people and knowledge and how this can inform their teaching.

Summary of Key Issues

Each chapter of this book reflects on food education teaching across a range of countries. The countries do not represent the full range worldwide; it is a selection based on international contacts of the editors who were interested and willing to contribute to the key issue of what, and how, children in the twenty-first century should learn, understand and be taught about food education. As noted in the Foreword, Stephanie Valentine comments that each country's approach is 'almost certainly shaped by place and time'. Overall, food education has a very broad remit; and this in itself can be a daunting factor when considering the school curriculum. It has the potential to provide young people with important life skills, but it also can lead to vocational opportunities in the hospitality and catering industry, future employment in a variety of roles in the food industry and a range of careers related to nutrition and dietetics. However, this book has attempted to identify some key issues:

- Historically, the backdrop of food education is essentially a derivative from the UK.
- There is a need for robust, academic scholarship and theoretical framing for food education, e.g. sociocultural theory, scientific theory (food science), technological understanding, product design, nutritional knowledge and cooking skills taught in an experiential, sequential and integrated approach.
- Interdisciplinary and cross-cultural teaching collaborations.
- Pathways and progression through the school curriculum and beyond the school gate into tertiary and higher education, research, the food industry and other food-related employment.
- The importance of ongoing professional learning and teaching.
- Teacher identity and transiting from industrial and vocational careers to initial teacher education pathways.
- Environmental issues, such as climate change affecting food production, biotechnology, food sustainability, food literacy, global food demand and supply and population growth.
- Healthy, safe and sustainable diets, obesity, changing patterns of consumption (less meat, less waste, less biofuel) together with new yield-increasing technologies.
- Links between food and exercise to reduce challenging behaviour.
- Community collaboration in growing, harvesting, storing and distributing food.
- The impact of environmental factors and changing patterns of consumption (less meat, more plant based food, less waste, less biofuel, a Mediterranean diet framework), together with new yield-increasing technologies on providing enough food globally to feed the world's population adequately throughout the twenty-first century.