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A Food Literacy Model for Food Education Program Design and Evaluation

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Abstract

Food literacy has emerged as a term used by home economics teachers to describe the knowledge and skills acquired in food education programs in secondary schools. This paper outlines the evolution of food literacy models based on Nutbeam's three-layered healthy literacy model and then proposes a new model for use by teachers to design and evaluate their programs. The model, based on the attributes of several others, is described and exemplified in a 21-item questionnaire. A pilot-survey to test the model was completed by a small convenience sample of 22 15 to 16-year-old students who responded to the questionnaire that covered the three levels of the model. The questionnaire was administered post-completion of a semester unit in food education. The findings showed that the evidence-based model was a reliable tool to evaluate food literacy and skill acquisition. More testing on the model and further development of the survey instrument would need to be performed in similar school settings to validate these preliminary findings.

KEYWORDS: FOOD LITERACY, FOOD SKILLS ACQUISITION, HOME ECONOMICS, TEACHERS, EVIDENCE-BASED MODELS

Introduction

The link between food knowledge and skill acquisition and mitigating the prevalence of obesity, particularly amongst young people, has been gaining interest amongst health and medical professionals (Lichtenstein & Ludwig, 2010; Markow, Coveney, & Booth, 2012; Slater, 2013). This interest has been somewhat of a revelation for public health professionals with their subsequent research and reporting of the work of food educators, primarily home economics teachers in schools (Burton & Worsley, 2014; Markow et al., 2012; Ronto, Ball, Pendergast, & Harris, 2016b; Slater, 2013; Vaitkeviciute, Ball, & Harris, 2015; Vidgen & Gallegos, 2011). Hitherto, there has been a dearth of evidence-based research of the home economics teaching profession. Recent acknowledgement of practitioners' work (Burton & Worsley, 2014; Nanayakkara, Burton, Margerison, & Worsley, 2018; Pendergast, Garvis, & Kanasa, 2011; Ronto et al., 2016b; Vaitkeviciute et al., 2015) has subsequently generated a renaissance of home economics and a call for evidence-based strategies to assist the work of teachers (Burton & Worsley, 2014; Lichtenstein & Ludwig, 2010; Markow et al., 2012). The use of simple and easy-to-use evidence-based models is one example of a strategy to help teachers to plan, evaluate and report on their skill-based programs. The aim of this paper is to set out the evolution of food literacy models, particularly those most relevant to food education, and then to describe the use of a practical, multi-directional food literacy model that is suitable for *all* food educators, those working in schools and in communities, to plan and evaluate their skill-based healthy eating programs. The term 'students' is used to refer to young people in schools whilst the term 'learners' is used more broadly to represent young people in schools and in the community.

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Rationale for using models for food skills program evaluation

While there has been anecdotal reporting of successful food skills programs in schools, the extent of this research has been largely limited to participants' self-reporting of 'confidence'. The use of 'confidence' as an indicator has been typically used by facilitators of food skills programs to measure program success, particularly in primary schools. Typical of such programs include *When chefs adopt a school* (Caraher, Seeley, Wu, & Lloyd, 2013), where the facilitators measured outcomes based on students' self-reporting of feeling confident in food preparation and cooking. In another program intervention designed to increase students' fruit and vegetable consumption administered across three primary schools in Denver, Colorado, the researchers acknowledged that participants' self-reporting of dietary behaviour was potentially subject to bias when they found that tested children increased reported intakes of fruits and vegetables (Auld, Romaniello, Heimendinger, Hambidge, & Hambidge, 1998). Whilst participants' self-reporting on dietary behaviours or cooking confidence as a means of determining program success may be used as one indicator, designers and facilitators of food skills programs require additional methods to secure the evidence they need to report on food skill acquisition. For home economics teachers in schools, this means that they need to have evaluation tools that can more objectively measure their students' skills acquisition, and ultimately, program success. From an educational perspective, program evaluation is important for teachers to measure the learning outcomes of their students to determine the success of their programs. This becomes crucial when funding of programs by schools, community and governments is conditional on participants' satisfactory program completion and skill acquisition outcomes. Despite these conditions, there are several reasons that account for the current lack of program evaluation. Several researchers indicated that facilitators such as home economics teachers fail to evaluate their programs either because they lack the time or the need to do so (Gussow & Contento, 1984; Markow et al., 2012; Worsley & Crawford, 2005) or crucially, the absence of adequate evaluation tools (Barton, Wrieden, & Anderson, 2011; Palumbo et al., 2017). Since these tools would contribute to the evidence teachers need to evaluate the success of their programs, an easy-to-use model for them to use in their food classes would expedite their program planning and evaluation. The next section outlines how (mainly) public health researchers and dietitians have responded to this dearth of reporting on the links between food literacy (and implicitly 'skills') and the current health and dietary status of young people.

Food literacy—evolution and revolution

Prior to the late 1990s there has been limited reporting of the term 'food literacy' in the scholarly literature; however, there has been burgeoning interest in, and reporting of food literacy in all its guises (definitions, implications on health status, application in school and community programs) over the last two decades.

Likewise, over this time researchers, health practitioners and home economics teachers have proposed various models and described how they underpin and strengthen their food education programs that aim to improve participants' eating behaviours and health outcomes. The next section provides an overview of some of the more relevant food literacy models and their use in school and community settings.

Food literacy models: description of models and the food literacy model

Typically, food literacy models have used health literacy theories and there have been efforts to link the two by researchers (Gillis, 2016; Palumbo et al., 2017; Velardo, 2015). Nutbeam (2000) devised the concept of health literacy as one based on social and environmental health factors that determined an individual's ability to take control of their health. However, with the focus on health and how the body utilises nutrients for growth and development, this concept may not be so relevant to food educators interested in a more preventive 'everyday focus on food' (Vidgen, 2016). Nonetheless, health literacy models provide an evidence-based starting point for health professionals and food educators. Food educators and practitioners have typically adapted Nutbeam's three levels of health literacy (functional, communicative/interactive and critical) to determine individual variations of self-efficacy. Several of them have conceptualised these to create, adapt or apply food models of their own to inform, plan and evaluate their programs. The following table (Table 1) summarises the content outlining the similarities and differences between other models presented elsewhere (Fordyce-Voorham, 2015) and displays an overview of the more relevant food literacy models.

Table 1 Overview of food literacy models

Theoretical Model	Description	Rationale
European food literacy (Schnögl et al., 2006) described by Colatruglio and Slater (Colatruglio & Slater, 2014)	Three-tiered approach in which the individual ‘organises everyday nutrition’ in: <ul style="list-style-type: none"> • a self-determined way • a responsible way • an enjoyable way. 	Focuses on an individual’s cultural norms and values to foster positive nutrition and healthy eating outcomes.
Food literacy framework (Slater, 2013) described by Colatruglio and Slater (Colatruglio & Slater, 2014) and Velardo (Velardo, 2015)	Three-tiered approach: <ul style="list-style-type: none"> • functional food literacy • interactive food literacy • critical food literacy. 	Designed to meet developmental capacities of individuals as they advance through programs.
Critical Food Literacy Competencies for Young Adults framework (Slater, Falkenberg, Colatruglio, & Rutherford, 2018)	Multi-directional approach <ul style="list-style-type: none"> • functional competencies (confidence and empowerment with food) • relational competencies (joy and meaning through food) • system competencies (equity and sustainability through food systems) 	Designed as a non-hierarchical framework with three sets of competencies to show the importance and scope of food literacy, to guide and help evaluate curriculum and program development and as an advocacy tool to promote food literacy policy and programs.
Food literacy-Food ‘Bildung’ (Benn, 2014)	Three-tiered approach: <ul style="list-style-type: none"> • nutrition literacy • food, growing, kitchen cooking literacy • cultural and social literacy. 	Presented as a pyramid to display three levels of food literacy designed to foster critical understanding of food, meals and wellbeing.
Critical food literacy (Renwick, 2013)	Three-tiered approach: <ul style="list-style-type: none"> • operational (interactions with food) • cultural (interactions with people and the near environment) • critical (interactions with the social environment). 	Presented as a non-hierarchical model displayed in three scaffolded dimensions that could be used independently or interdependently to meet developmental capacities of individuals as they advance through programs.
Food literacy assessment tool (Palumbo et al., 2017) based on Vidgen and Gallegos’ Food Literacy Construct (Vidgen & Gallegos, 2014)	Three-tiered approach: <ul style="list-style-type: none"> • functional (ability to plan and manage food) • interactive (ability to select and choose food) • critical (ability to prepare and consume food) 	Presented as three conceptual domains to create a survey tool of 101 items to test participants’ level of food literacy.

Generally, models depicting food literacy use a multi-layered or tiered approach based on Nutbeam’s scaffolding of three health layers to represent basic, intermediate and advanced levels of food literacy in order to accommodate the developmental needs of program users, such as students in schools and (often disadvantaged) young people in the community.

Velardo (2015) summarises the three-layered food/nutrition literacy approach and provides relevant examples for home economics teachers to apply in their food programs. These include Functional food/nutrition literacy (‘declarative’ knowledge of understanding how to read food labels or the foods required for a healthy diet); Interactive food/nutrition literacy (‘procedural’ application of knowing how to plan, shop and prepare the foods to make a healthy meal). The third layer; Critical food/nutrition literacy encompasses higher ordered-principles that might motivate an individual to make food decisions based on concepts such as food miles, ethical or sustainable food supply. Ronto et al. (Ronto, Ball, Pendergast, & Harris, 2016a) uses the term *macroaspects* of food literacy to describe these higher-ordered principles which were prioritised less by the respondents due to time and curriculum constraints in favour of the *microaspects* of food literacy, the cooking skills and use of tools and equipment, that were usually taught. Notwithstanding, the skills in making healthy food is acknowledged as an ‘essential component of translating nutrition knowledge into dietary practice...’ (Velardo, 2015) and operates in Benn’s (2014) description of the concept of nutrition literacy or ‘*Bildung*’. Here, Benn describes a hierarchical approach to food from meeting physiological dietary requirements in Level 1, to structuring food into groups (Level 2) and then transforming them

into food (Level 3) that reflects the dietary practices and socio-cultural habits over time and place (Level 4).

In an extension of Benn's socio-cultural approach (Level 4), Renwick (2013) proposes a food literacy model adapted from Green's (1999) Health literacy model. Targeting home economics teachers, Renwick uses an example of the globalisation of food supply to outline critical food literacy in three scaffolded dimensions (*Operational*, *Cultural* and *Critical*). At the Operational (basic) level, learners might investigate the foods available in short supply; at the Cultural (intermediate) level learners might apply this knowledge and evaluate their own and family's food choices on dietary health. At the Critical (advanced) level, learners might integrate this knowledge to make informed decisions on the likely impact on global food supply and the environment.

Renwick then explains how teachers could use the model to stimulate learners to engage in *meta-cognitive* critical thinking and to become active, rather than passive learners. To do this, teachers start the learning process with a familiar content base. Once the learners engage with the content, teachers encourage them to move beyond their own world where together they embark on a journey to become critical and reflective thinkers (Fordyce-Voorham & Lai Yeung W-L, 2016) in a process that may be described as 'differentiated learning' (Tomlinson & Imbeau, 2014).

The Food Literacy Model (Figure 1) integrates the attributes of the most relevant models (Renwick, 2013; Slater, 2013) that are largely hierarchical or layered in design. However, the Food Literacy Model best aligns with the updated framework 'Critical Food Literacy Competencies for Young Adults' (Slater et al., 2018) that incorporates components such as sustainability and confidence in a multi-directional format. Multi-directional models such as these allow the teacher and student to move flexibly in, and between each dimension to accommodate differentiated learning.

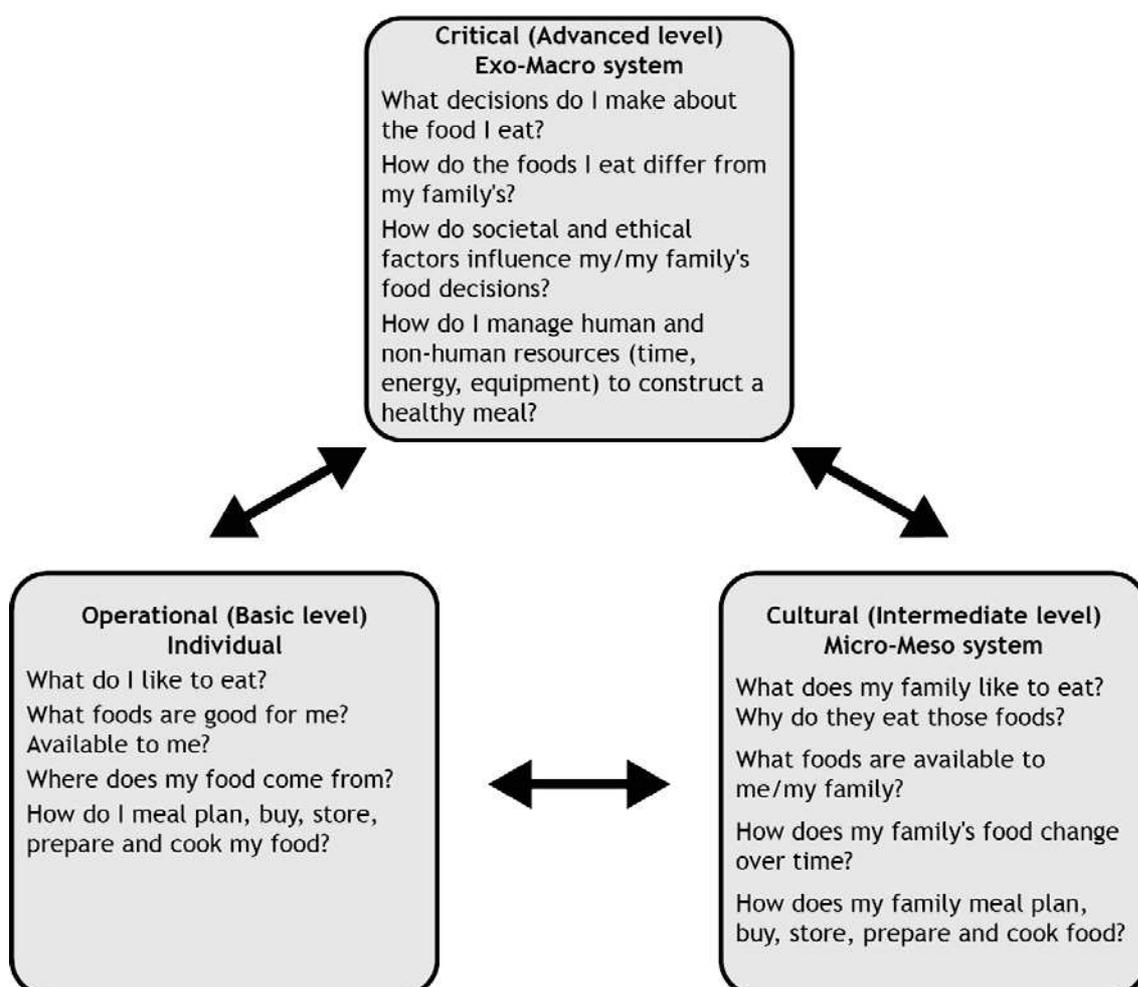


Figure 1 A food literacy model for schools (Fordyce-Voorham, 2015)

The use of the model in food education programs

The food literacy model for schools consists of three levels comprising Basic, Intermediate and Advanced food literacy skills.

Basic level

The food tasks performed at this level focus on the learners and their interactions with food. Examples of food literacy at this level include an understanding of:

- A learner's food likes and dislikes
- how different varieties of food are accessed (for example, fresh and processed)
- the origins of food ('paddock to plate')
- chemical (nutritional) and sensory (aesthetic) properties of food in relation to health.

This also includes the ability of learners to prepare and cook food for themselves and to enjoy the pleasure of eating good food shared with others. This level aligns with Renwick's (2013) *Operational dimension* in her critical food literacy model, *Functional food literacy* and especially the *Interactive food literacy* in Slater's (2013) food literacy framework and the *Relational Competency* in the more recent framework (Slater et al., 2018). Others nominate this as a critical level of food literacy and argue that this interactive experience provides sufficient impetus to develop people's understanding of the consequences of food-related decisions on individual well-being, sustainability and wider social issues (Palumbo et al., 2017).

Intermediate level

The food tasks performed at this level involve the individual interacting with people (family, teachers, students and local vendors) in their near environment.

Examples of food literacy at this level include an understanding of:

- family food likes and dislikes
- who makes food decisions ('gate-keeping' of food—who and what influences the food planned, purchased, stored, prepared and consumed in the home and school)
- availability of, and access to food in the home (for example, farmyard and backyard/balcony gardens for production and/or preservation of, for example, eggs, fruits, nuts and vegetables) and in the community (for example, supermarkets; strip shopping fresh-food vendors such as butchers, greengrocers and bakeries; roadside stalls and farmers' markets).

It also includes the ability to:

- contribute to family food decision-making
- prepare and cook healthy meals for the family.

This level aligns with Renwick's (2013) *Cultural dimension*, the *Critical food literacy* described by Slater (2013) and the *Relational competencies* nominated in the more recent framework (Slater et al., 2018).

Advanced level

The food tasks performed at this level involve the individual interacting with the social environment (media, culture, society, technology) and making ethical decisions about food. Examples include knowledge and understanding of social (including television, digital and print media, marketing activities and technology), ethical, sustainability and cultural factors influencing family food decisions and choices. This also includes the ability to manage resources to prepare and cook healthy meals.

This aligns with Renwick's (2013) *Critical dimension*, Slater's (2013) *Critical food literacy* and *Food Literacy Competencies for Young Adults* (Slater et al., 2018). This concept of a food-literate individual operating as a citizen able to make ethical and responsible food decisions also aligns with Schnögl et al.'s (2006) *European food literacy*.

Each level operates independently or interrelates as indicated by the bidirectional arrows. An individual can access and return to any level without the need to progress from the basic through to the intermediate and advanced levels of food literacy skills. A feature of this model (Figure 1) is its purpose-built and generic design for use by teachers or community food educators, irrespective of mandated curriculum. Further, the model is sufficiently generic to accommodate local, national and global food education curricula in school settings and applies equally to practitioners in non-formal settings in community food programs.

Preliminary testing and reporting of the results of the Food Literacy Model

This section summarises the results of a pilot study reported fully elsewhere (Fordyce-Voorham, 2015). The aim of this pilot study was to test the model by linking 21 questions based on the three levels of the model to provide initial feedback on the development and progress of students' procedural (practical) food skills.

Methodology

The pilot study of a small convenience sample of 15 to 16-year-old students ($n = 22$) was conducted in an independent K-12 girls' school in Melbourne, Australia. The students responded to a series of questions that aligned with each of the three levels of the model after they had completed a fifteen-week semester Food unit comprising two 75-minute lessons each week. The aim of the questionnaire was to provide feedback to teachers on students' food skills acquisition and how effectively they delivered this in the classroom based on the students' level of agreement to the question items. The questionnaire comprised 21 items related to food skills acquisition across the three levels.

Eleven pedagogical questions covering teaching and learning practices and program delivery were also included in the student questionnaire to make 32 questions (21 food literacy and 11 pedagogical questions). An additional question (Qn 8) was included post-questionnaire in the Basic section to accommodate an individual's confidence in their ability to cook a healthy meal for themselves, a fundamental indicator of program success (Caraher, Seeley, Wu, & Lloyd, 2013; Stead et al., 2004; Wrieden et al., 2007). Table 2 displays the questions and the preliminary results (shown in percentages). The 'Strongly Disagree' label was removed from the presentation of data as no respondent selected this level of response to any question.

Response Rate

Of the 22 students who had completed the program, 15 students responded and completed the questionnaire, representing a 68 per cent response rate. Seven students declined the request to complete the post-program questionnaire.

Face validity based on the respondents' ability to complete the test within 10-15 minutes without recourse to teacher assistance aligned with the measurement proposed by Nevo (1985) when non-professional users (students) rate tests (questionnaires) as suitable for use.

Table 2 Respondents reported level of agreement of food skills acquisition for Basic, Intermediate and Advanced levels of food literacy

Basic		SA	A	N	D
		%	%	%	%
1.	I have a better understanding of what fruits and vegetables are in season and how to prepare and cook them.	40	47	13	0
2.	I am more likely to try a new food.	33	33	20	14 ⁵
3.	I have a better understanding of the food I need to eat to keep me healthy.	27	53	20	0
4.	I have more confidence to prepare and cook new and familiar recipes.	40	40	20	0
5.	I have a better understanding of where fresh food comes from and how I can buy it.	40	27	27	6
6.	I have a better understanding of how I can make food look and taste better.	40	33	27	0
7.	I feel more confident that I can prepare and cook a healthy meal for myself ³ .				
Intermediate		SA	A	N	D
1.	I have a better understanding of judging how much food to make to avoid food waste	40	48 ⁵	6	6
2.	I have a better understanding of why I choose to eat particular foods.	33	53	7	7
3.	I have a better understanding of why my family chooses to eat particular foods.	40	27	27	6
4.	I have a better understanding of how the media ¹ influences people's food choices.	27	40	20	13
5.	I feel more confident that I can contribute to the way my family decides what to eat.	40	40	20	0
6.	I feel more confident that I can buy sufficient food to satisfy my family's appetite without food wastage.	33	47	20	0
7.	I feel more confident that I can buy, prepare and cook a healthy meal for my family.	53	34 ⁵	13	0
Advanced		SA	A	N	D
1.	I can justify my decisions for eating the foods I do.	27	40	20	13
2.	I feel more confident in integrating tasks in order to finish work efficiently within the time limit.	33	47	20	0
3.	I have more confidence in managing safety, heat control and food hygiene during food preparation	40	47	13	0
4.	I have more confidence in judging the information about food presented in the media	27	40	20	13
5.	I have more confidence in making ethical decisions about the foods I eat.	33	27	40	0
6.	I feel that I could present a case for a moral or ethical decision about food ² .	33	34 ⁵	13	20
7.	I can identify factors that might influence why people in different countries eat different foods to me.	53 ⁵	20	27	0
8.	I have the skills to evaluate my own and other's eating, shopping and sustainability practices ⁴ .	40	40	20	0

1. Television, print and Internet
2. For example; banning caged eggs or eating one meat-free meal a week
3. Not reported
4. For example, acting on food conservation measures to prevent food wastage.
5. Rounded up to next whole number to equal 100%

Results

These preliminary results displayed a high level of agreement amongst the respondents that the food skills program delivered over one semester had improved their food skills acquisition, based on the questions covered in the three levels of the food literacy model.

At the **Basic level**, there was a high level of agreement (up to 87% for Strongly Agreed (SA) and Agreed (A)) that the program increased respondents' ability to cook fruit and vegetables (Qn 1), eat for health (Qn 3), cook for health (Qn 6) and cook confidently (Qn 4). Up to one-third of respondents

recorded lower levels of agreement (Neutral (N) or Disagreed (D)) for trying a new food (Qn 2) and sourcing and purchasing fresh food (Q 5).

At the **Intermediate level**, there was a high level of agreement (up to 87% Strongly Agreed or Agreed) that the program increased respondents' ability to buy, prepare food and cook confidently (Qn 7), make food choices (Qn 2) and avoid food waste (Qn 6). A slightly lower percentage (up to 80%) of respondents agreed or strongly agreed that they were able to better judge food quantities (Qn 1) and participate in family food decision making (Qn 5). Less certain were respondents' level of agreement (67%) for understanding media and familial influences on food choices (Qns 3 and 4).

At the **Advanced level**, there was a high level of agreement (up to 87%) that the program increased respondents' ability to manage practical tasks safely, hygienically (Qn 3) and efficiently (Qn 2) as well as being able to evaluate their own and other's eating, shopping and sustainable practices (Qn 8). Less certain were respondents' level of agreement (67%) for judging the information presented in the media (Qn 4) and making judgements (Qn 1) and ethical decisions about food (Qns 5 and 6).

In summary, the initial findings suggested that the questionnaire was a successful tool on two indicators. Firstly, the questionnaire showed that at least two-thirds of respondents reported that the program increased their food skills ability for 20 of the 21 items. Secondly, respondents were able to distinguish between the three levels of food literacy for the 21 items, as there was a correlation with the increased level of neutrality and disagreement amongst respondents and the advancement of food literacy skills. As to be expected, respondents nominated a higher level of neutrality or disagreement as the questions progressed from the basic to the advanced levels of food literacy skills. This suggested that the level of food literacy would advance alongside the students' length of exposure to, and level of participation through a sequential food skills program.

Discussion

The concept of a multi-directional approach used in both this model and the Critical Food Literacy Competencies for Young Adults framework (Slater et al., 2018) provides flexibility for home economics teachers to design food literacy programs that support students' sequential food skills development and healthy eating behaviours. Here, students with no previous exposure to food skills programs could enter a program at a basic level whilst returning students could recommence at a more advanced level or move in and between the basic, intermediate or advanced levels.

In the current pilot study, the interactive structure of the program design involved teacher and student-directed activities that provided opportunities for students to make specific and useful feedback on the program quality. Several participants chose to make comments for program improvement; these related to specific articulation of the skills covered in class that better matched the questionnaire items and provided more opportunities to cater for individualised student learning. Differentiation in the classroom is important for engaging students (Dalton, 2015) and to ensure that they have multiple options to advance their learning (Tomlinson, 2013).

Student involvement in the program design has additional merits that contribute to the success of food literacy programs, including healthier eating behaviours. The findings made in a recent Australian survey of 205 home economics teachers reported that students' active engagement in practical food tasks contributed to their healthier diets and eating practices (Ronto et al., 2016a, 2016b). Conclusions drawn from this survey endorsed the findings elsewhere that teachers prioritised the essential food skills (Fordyce-Voorham, 2010; Pendergast & Dewhurst, 2012) and focused on what has been described as *microaspects* of food literacy; namely cooking skills rather than the *macroaspects* of food literacy, such as environmental sustainability and ethical food decisions. In the same survey, the teachers reasoned that the *macroaspects*, the more 'theoretical' content, had been typically covered in other subject areas and consequently focused more on the practical skills that had not been covered elsewhere. Therefore, it makes sense that a course based on the food literacy model and embeds these macroaspects and microaspects would be an efficient way of helping teachers to condense the learning content and cover these higher-ordered critical food literacy skills, particularly in a way that engages students through practical tasks that they enjoy. The results of this pilot study show how this could be done in small-scale food literacy/skills programs where time and crowded curriculum constraints are a continual source of frustration for teachers (Ronto et al., 2016a; Smith, 2009).

Implications for research and practice

Whilst small-scale in approach, the results have been encouraging and more testing would provide further data to refine the survey instrument. Nevertheless, the generic design of the instrument makes it applicable to a diverse range of schools and gives it broad appeal for use both by teachers in schools and food educators in community settings, where food education programs may operate. The proposed food literacy model is evidence-based and underpins the survey, an important consideration in the design of any healthy eating intervention (Hoelscher, Evans, Parcel, & Kelder, 2002). While more testing needs to be performed on the model and the survey instrument, the current questionnaire (Table 2) can already be adapted for use by any food educator to assist with the design, implementation and evaluation of their programs.

Limitations

This pilot study was small with a convenience cohort of a selected year level of students studying food skills at one school. More testing at this, and other schools including co-educational, state, Catholic and independent schools across metropolitan and regional areas would need to be done to verify and broaden the results to a more diverse student population. Sequential testing of the instrument administered in subsequent year levels as students advanced through the school would provide further insights into their progression of food skills and transferability to healthy eating behaviours in the longer term.

Conclusions

The results of a pilot study of a small sample of 15 to 16-year-old students based on a questionnaire that covered 21 incrementally complex nominated food skills, suggest that essential food skills can be acquired in small-scale food literacy and skill-based healthy eating programs. The questionnaire items based on the Food Literacy Model provide teachers with an evidence-based tool to build and evaluate their programs. However, more testing on this and other models described would need to be done to validate the current findings and provide further evidence on which teachers can design and evaluate programs that develop students' food literacy as well as cultivate an environment that stimulates and differentiates their learning.

Biography

Sandra Fordyce-Voorham trained in Home Economics and has been working as a food educator in schools for many years. Her PhD (University of Wollongong) research augments the consultancy work she is currently undertaking in promoting food skills in schools and communities. She is a past-President of Home Economics Victoria and former Education Chair with the International Federation for Home Economics. She is a co-author of *The Food Book* which is used widely in food education programs in schools across Australia

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