

## **Supporting nutrition education in low socioeconomic schools in Western Australia**

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School-based nutrition education (NE) has an important role in promoting healthy eating habits and helping prevent chronic diseases – particularly among disadvantaged children and youth who are more likely to experience poor diet quality. However, teachers report being underprepared or time-poor in delivering NE and there is a growing trend for schools to outsource health-related content to external providers. This study evaluated the effect of an experiential NE session on Years 3-12 students (N=1,714) and teachers (N=178), developed and facilitated by a hunger relief charity for low socioeconomic schools that access a school breakfast program. The results showed significant increases ( $p < 0.001$ ) in student knowledge and attitudes towards healthy eating. Teachers indicated they improved their knowledge of how to teach children about healthy eating and were motivated to include more NE in their teaching programs. The study shows that targeted, experiential NE sessions delivered by external experts can improve students' knowledge and attitudes toward healthy eating post-intervention and may reduce barriers to the provision of ongoing teacher-led NE. The opportunities for sustained impact in the context of a school breakfast program are discussed.

### **Introduction**

Good nutrition is paramount for the healthy development and wellbeing of children and adolescents (British Nutrition Foundation, 2013; National Health and Medical Research Council [NHMRC], 2013; Scientific Advisory Committee on Nutrition, 2011). Since eating patterns developed in childhood are likely to continue through to adulthood (Racey et al., 2016; Watson et al., 2009), teaching and supporting healthy eating behaviours from an early age is important to reduce the risks of developing long-term health problems and chronic diseases (CDC, 2011; WHO, 2020). Children and adolescents living with socioeconomic disadvantage are more likely to experience poor diet quality and related health consequences compared with those of higher socioeconomic backgrounds (Wilkinson & Marmot, 2003; Williams, Veitch & Ball, 2011). By providing a consistent learning environment, schools have the potential to promote nutrition education (NE) to children and youth from diverse backgrounds to bridge this divide (CDC, 2011; Chaudhary et al., 2020; WHO, 2021).

A substantial body of research indicates that school-based NE interventions can be effective in improving the nutritional knowledge of children and youth (Chaudhary et al., 2020; Cotton et al., 2020; Murimi et al., 2018; Racey et al., 2016), including those from minority and disadvantaged communities (Oldroyd et al., 2008). While improved

knowledge of healthy eating does not automatically translate to change in dietary behaviours (Puma et al., 2013), systematic reviews and meta-analyses show that school-based NE programs can improve students' dietary habits post-intervention (Chaudhary et al., 2020), such as increasing fruit and/or vegetable intake (Evans et al., 2012; Howerton et al., 2007), and decreasing overall energy intake and sugar consumption (Cotton et al., 2020; Dudley et al., 2015). However, since few studies of school-based nutrition interventions include long-term follow-ups, it is unclear whether improvements are sustained (Racey et al., 2016; Wang & Stewart, 2013).

Contento (2008, p. 177) argued that effective NE has three essential components: a "motivational phase" focused on "*why to make changes*", an "action phase" focused on "*how to make changes*", and an "environmental component" aimed at boosting participants' prospects for taking positive action, such as increasing the availability and affordability of healthy food options. The findings of several systematic reviews of NE for children and/or youth support the efficacy of a multi-component approach (Chaudhary et al., 2020; Evans et al., 2012; Knai et al., 2006; Murimi et al., 2018; Silveira et al., 2011). Such reviews also emphasise the importance of experiential learning opportunities (Dudley et al., 2015; Murimi et al., 2018) and an "enabling environment" in which schools provide healthy meals and/or access to healthy food choices and consistent messages about nutrition (Knai et al., 2006; Silveira et al., 2011).

Research evidence suggests cooking classes may have a particularly important role within school-based NE. Large-scale studies have demonstrated positive associations between diet quality and involvement in food preparation among pre-teens (Chu et al., 2014) and young adults (Larson et al., 2006). Within a European adult population, Hartmann et al. (2013) found an association between cooking skills and healthy food choices and concluded that teaching cooking to children and adolescents could equip them to make healthier food choices - particularly those from low-income families who may have "limited access to other resources of information" (p. 130). Studies involving children show that cooking and NE programs can improve students' preferences for vegetables and unfamiliar foods and build skills and confidence to prepare healthy meals (Cunningham-Sabo & Lohse, 2014; Hersch et al., 2014; Jarpe-Ratner et al., 2016; Zahr & Sibeko, 2017). However, as with other school-based NE interventions, there is insufficient evidence about the long-term effects of children's cooking programs (Hersch et al., 2014).

Various studies have highlighted the enablers and barriers to the delivery of effective school-based NE where there are competing priorities and constraints on teachers' time (Cho & Nadow, 2004; Kupolati et al., 2014) due to an "already 'crowded curriculum'" (Love et al., 2020, p. 1295). Targeted pre-service training and in-service professional development are flagged as necessary to ensure teachers have the requisite knowledge, confidence, and motivation to deliver NE (Boddy et al., 2019; Cho & Nadow, 2004; Wang & Stewart, 2013). Appropriate teaching resources are also essential to support quality NE (de Vlieger et al., 2019; Love et al., 2020; Watts et al., 2012), in particular, to avoid teachers drawing on inappropriate or non-scientific nutrition information from social media and other online sources (Boddy et al., 2019; de Vlieger et al., 2019).

In Australia, NE is embedded in the Health and Physical Education (HPE) and Technologies (as Home Economics, Food Studies, or Food and Fibre) learning areas of both the Australian and Western Australian (WA) Curriculum. Despite its inclusion in two of the eight learning areas, adequate school-based NE is not guaranteed since teachers have considerable latitude in determining lesson content. This is exacerbated by the perceived lower status of HPE and Home Economics compared to subjects that are deemed more academically challenging (Bleazby, 2015; Cruickshank et al., 2020; Gaudreault et al., 2018; Langford et al., 2015) or covered by national and international testing programs (Bleazby, 2015; Cruickshank et al., 2020). In primary schools, HPE and Technologies are mainly delivered by generalist teachers who report feeling under-prepared to deliver health-related content and pressured to focus on other learning areas (de Vlieger et al., 2019). Although secondary schools typically have specialist HPE teachers, “out-of-field” teaching is high within health education (Barwood et al., 2017) and usually allotted less time than the physical education component of the HPE syllabus (Barwood et al., 2016). Hence, primary and secondary teachers who feel ill-prepared or unmotivated to deliver particular health-related content may give it minimal coverage or avoid it altogether.

The outsourcing of HPE content (including NE) to external providers is an increasing phenomenon (Leahy et al., 2016; Williams, Veitch & Ball, 2011; Williams & Macdonald, 2015). As Leahy et al. (2016, p. 113) pointed out, “private providers have both time and resources to specialise in particular aspects of health education (e.g. sexuality education, nutrition, mental health)”. However, educational concerns about outsourcing include a lack of alignment to curricula, inadequate evaluation of resources, limited affordability (Leahy et al., 2016), and insufficient differentiation to cater for diverse student needs and interests (Macdonald et al., 2008).

Given the challenging context of school-based NE and concerns about outsourcing, the present study sought to evaluate the *Food Sensations for Schools* (FSS) NE program, delivered free of charge to low socioeconomic WA primary and secondary schools by the hunger-relief charity Foodbank WA. A previous evaluation of FSS in 2012 found 90% of students ( $n=2,210$ ) learned that it was easy to cook healthy food and teachers ( $n=230$ ) agreed that it improved student knowledge (Butcher et al., 2014). The main aim of the current study was to determine if the targeted NE sessions delivered by the external provider in 2016-2017 increased students’ nutrition knowledge and positive attitudes towards healthy eating and, importantly, positively influenced teachers’ knowledge and motivation to incorporate more NE in their teaching programs.

## **Program overview**

FSS is the classroom NE component of the *School Breakfast and Nutrition Education Program* (SBNEP) developed and facilitated by Foodbank WA. More than 450 schools participate in the Foodbank WA School Breakfast Program (SBP) each year. To gain access to the SBP, and therefore FSS, schools must be below the 50th percentile on the Australian Index of Community Socio-Educational Advantage (ACARA, 2020) or be able to identify

vulnerable groups within their school community, including Aboriginal and Torres Strait Islander (Indigenous) students, culturally and linguistically diverse students, or other students experiencing disadvantage.

The design of FSS is based on social learning theory (Bandura, 1977), applying the concept that observing, imitating and modelling the behaviour of others (in this case facilitator(s), helpers and peers) in preparing and enjoying healthy foods can motivate students to try similar behaviour, especially those at risk of food insecurity (Butcher et al., 2014; Butcher et al., 2021). Social ecological theory (Stokols, 1996) is also applied, with the underpinning SBP aiming to facilitate a health-promoting environment (WHO, 2021) at individual, interpersonal and organisational levels to support behaviour change (Butcher et al., 2014).

FSS targets children from Foundation (Pre-Primary) to Year 10, though schools may choose to include Year 11 and 12 students. The Foodbank WA university-qualified nutritionists who deliver FSS receive training in culturally responsive pedagogy and classroom behaviour management practices to ensure they can effectively facilitate the lessons, engage children, and generate discussion. As schools' demand for FSS exceeds Foodbank's staffing capacity, particularly in regional and remote areas, a delivery model was developed in partnership with regional health organisations whereby Foodbank WA provides comprehensive training to other health professionals (e.g. dietitians, nutritionists, nurses, Aboriginal Health Workers) so they can independently deliver FSS to SBP schools in their catchment area and thus extend the program reach by more than 50%. The present study only relates to FSS sessions delivered by Foodbank WA staff.

FSS lessons are typically 90 minutes in duration and include interactive classroom activities and a hands-on cooking session in which every child helps to prepare one or more healthy dishes that are shared with the whole class. Schools can also choose to invite parents to attend the FSS sessions as helpers or observers. The cooking sessions do not require specialist kitchen facilities, only access to power for electric fry pans and water for rinsing foods and washing hands and dishes/utensils. Lesson plans (e.g. "Eat like a rainbow snake"; "Australian guide to healthy eating race"; "Sugar in drinks"; "Homemade vs takeaway"; "Joe's food choices"; "Value for money") are tailored to particular year groupings (Foundation-Year 2, Years 3-6, 7-8, 9-10), linked to the Australian/WA Curriculum, and made available free-of-charge to teachers from the Foodbank WA "Superhero Foods HQ" website (Foodbank WA, 2023). The initial download is free, but subsequent downloads do attract a fee. Each student receives a free, colourful booklet to take home containing simple recipes for healthy meals and snacks.

Foodbank WA developed and trademarked cartoon characters to enhance the delivery of NE in the school setting. *Superhero Foods* comprise a series of more than 90 characters depicting inexpensive, readily available "everyday foods" that promote good health, such as fruits, vegetables, dairy, lean meats, and whole grain products, including traditional Indigenous "bush tucker foods" (Tartaglia et al., 2022, p. 1). The key message of the *Superhero Foods* is that they create a strong mind and healthy body. *Zombie Foods* comprise five characters depicting discretionary food items such as fast foods, sugary drinks, and

confectionery. Key messaging around *Zombie Foods* is that these are extra or “sometimes foods”, not everyday foods, and are associated with illness, obesity, and decay. Schools can access a range of free food literacy resources that feature the *Superhero Foods* and *Zombie Foods* and their associated health messages, including posters, playing cards, storybooks, and placemats for use in the SBP and other school activities (Foodbank WA, 2023; Tartaglia et al., 2022).

## Methods

### Instruments and procedures

Pre/post student evaluations of FSS sessions are conducted by Foodbank WA as part of ongoing program monitoring. Classroom teachers are asked to complete a post-session evaluation, while students complete an evaluation sheet up to 2-weeks before and soon after each FSS lesson aimed at gauging change in their knowledge and attitudes to healthy eating. For this study, two age-specific instruments to assess knowledge and attitudes of students in Years 4-6 and Years 7-12 were developed and piloted in late 2015 and used in schools throughout 2016-2017. The pre- and post-versions of each instrument were identical and included images/graphics to assist low literacy groups. The questions were answerable via tick box or circling of alternative options and covered simple demographics (gender and year group) plus knowledge, attitudes and skills relating to healthy eating and food preparation. School remoteness classification (a WA system of four categories based on relative access to services) was added by the research team.

The questions relating to student knowledge covered the identification of healthy food choices, nutritional features of fast foods, amount of sugar in a typical can of soft drink, interpretation of a nutrition information panel, and food preparation safety. Total “knowledge scores” were calculated by summing all the correctly answered items (Year 4-6 maximum score = 34; Year 7-12 maximum score = 35). Nine items were the same on both instruments.

To gauge attitudes towards aspects of healthy eating and the preparation of healthy meals, students were presented with a series of statements (Year 4-6: 8 items; Year 7-12: 9 items) with response categories of *yes*, *no* and *I don't know*. Pre/post percentages of responses reflecting positive attitudes (i.e. *yes* or *no* responses, depending on the item wording) were calculated for each item.

Feedback from participating classroom teachers was collected via an evaluation sheet comprising 17 items completed at the end of each FSS session. Items were measured on a 4-point Likert-type scale (strongly agree = 4; agree = 3; disagree = 2; strongly disagree = 1) and covered appropriateness of the lesson content (age, literacy, numeracy, social context), student enjoyment and skills learned, alignment with curriculum requirements, effect on students’ knowledge and attitudes towards healthy eating, impact on their own knowledge and practice concerning NE, intention to use the FSS support materials within their own classroom teaching, and further comments or feedback. Approvals for the study were obtained from the Edith Cowan University Human Research Ethics Committee

(13927), WA Department of Education (D15/0546601, D16/0620867), and Catholic Education WA (7/12/2015).

### Statistical analysis

The students' knowledge sum scores were not normally distributed, therefore, differences between pre- and post-participation in FSS were tested using the non-parametric Wilcoxon signed rank test for related samples (Sawilowsky, 2007). The results are reported as medians and interquartile (IQR) ranges. To reduce the likelihood of Type 1 error, Bonferroni corrections (McEwan, 2018) were applied for multiple comparisons of gender and school remoteness. For the attitude items, significant positive changes among primary and secondary students were tested at the individual item level only using the non-parametric asymptotic McNemar's test (Fagerland et al., 2013). Results of the post-program teacher evaluations are reported as percentages.

## Results

### Participants

In 2016-2017, 77 schools were included in the FSS evaluation. A total of 1,714 students completed the FSS program and evaluation, comprising 1,492 primary school students and 222 secondary school students. Post-evaluations of the program were completed by 178 teachers from 77 schools. Table 1 summarises the demographic characteristics of the participating students and teachers.

Table 1: Characteristics of *Food Sensations for Schools* participants (sub-groups may not sum to the group total due to missing data)

Characteristics		<i>n</i>	%
<i>Students</i>		1,714	
Gender	Male	804	46.9
	Female	894	52.1
Education stage	Primary school	1,492	87.0
	Secondary school	222	13.0
School year	Year 3	79	4.7
	Year 4	426	25.6
	Year 5	591	35.5
	Year 6	353	21.2
	Year 7	41	2.5
	Year 8	46	2.8
	Year 9	42	2.5
	Year 10	28	1.7
	Year 11	44	2.6
	Year 12	16	1.0
	School remoteness classification	Metropolitan	942
Provincial		657	38.3
Remote		91	5.3
Very remote		24	1.4

<i>Teachers</i>		178	
Teaching focus	Primary	103	58.2
	Secondary	47	26.6
	Primary and secondary	27	15.2
School remoteness classification	Metropolitan	88	49.4
	Provincial	69	38.8
	Remote	12	6.7
	Very remote	9	5.1

### Student results

The median knowledge scores for primary and secondary school students are presented in Table 2. Significant improvements ( $p < 0.001$ ) overall were evident for both cohorts. Subgroup analysis showed significant improvement ( $p \leq 0.001$ ) for both primary and secondary students irrespective of gender. However, improvements according to school remoteness classification were not significant for primary students based in very remote schools nor secondary students in remote and very remote schools.

Table 2: Primary and secondary school students' knowledge of healthy food and nutrition (median score and interquartile range, IQR), pre- and post-participation in FSS, by gender and school remoteness classification ( $n=1,714$ )

		<i>n</i>	Median score (a) (IQR)		Wilcoxon signed rank test	
			Pre	Post	<i>z</i>	<i>p</i>
<i>Primary school</i>		1,492	26.0 (6)	30.0 (4)	-23.708	<0.001 (b)
Gender	Female	791	27.0 (6)	30.0 (5)	-19.757	<0.001 (b)
	Male	687	26.0 (6)	29.0 (5)	-13.412	<0.001 (b)
Remoteness classification	Metropolitan	811	27.0 (5)	30.0 (4)	-17.367	<0.001 (b)
	Provincial	609	26.0 (6)	29.0 (5)	-15.007	<0.001 (b)
	Remote	55	25.0 (7)	30.0 (6)	-5.214	<0.001 (b)
	Very remote	17	24.0 (4)	30.0 (5)	-2.424	0.015
<i>Secondary school</i>		222	26.0 (6)	29.0 (7)	-6.305	<0.001 (b)
Gender	Female	103	27.0 (6)	30.0 (6)	-5.586	<0.001 (b)
	Male	117	26.0 (8)	27.0 (8)	-3.263	0.001 (b)
Remoteness classification	Metropolitan	131	26.0 (7)	28.0 (7)	-5.063	<0.001 (b)
	Provincial	48	27.0 (6)	30.0 (7)	-3.332	0.001 (b)
	Remote	36	27.0 (7)	27.5 (8)	-1.561	0.120
	Very remote	7	19.0 (12)	24.0 (6)	-1.272	0.200

(a) Score ranges: Primary students=0-34; Secondary students=0-35.

(b) Statistically significant. Alpha level adjusted from 0.05 to 0.008 based on the Bonferroni correction for multiple testing.

Table 3 shows the percentage of positive responses to each of the attitudinal survey items and compares the pre- and post-results for the primary and secondary students. The item regarding value for money of "sometimes foods" versus "everyday foods" (item 9) was only included in the secondary school (Years 7-12) instrument. Collectively, students started with relatively positive attitudes. For the primary students, McNemar tests revealed

small but statistically significant improvements in positive attitude from pre- to post-assessment for all items except *Zombie Foods will give me a strong mind and healthy body* and *If I eat vegetables I will feel strong*. Secondary school students showed significant improvements for five of the nine items. Non-significant items, in addition to those for primary students, were: *Sometimes Foods are better value for money than Everyday Foods* and *Healthy food can taste delicious*.

Table 3: Proportions of primary and secondary school students with positive attitudes to healthy eating, pre and post participation in FSS

Attitude items <sup>c</sup>	Primary (a) %		Secondary (b) %	
	Pre	Post	Pre	Post
1. Everyday Foods will give me a strong mind and healthy body	72.5	85.8 (d)	79.0	94.4 (d)
2. Healthy homemade meals are easy to prepare	76.7	89.2 (d)	76.9	93.0 (d)
3. Zombie Foods will give me a strong mind and healthy body <sup>c</sup>	92.4	93.5	84.5	86.2
4. If I eat vegetables, I will feel strong and healthy	94.6	95.8	95.7	96.4
5. I try to choose healthy foods when I can	81.6	86.5 (d)	75.2	92.2 (d)
6. I choose Zombie Foods instead of Superhero Foods if I can <sup>c</sup>	77.5	82.8 (d)	60.2	76.2 (d)
7. Healthy foods can taste delicious	88.5	92.3 (d)	91.0	94.8
8. I can easily make a healthy meal	84.6	92.6 (d)	83.3	96.4 (d)
9. Sometimes foods are better value for money than everyday foods <sup>c</sup>	N/A	N/A	33.6	40.5

(a)  $n=1,492$  for items (1) to (8).  
(b) Item (1):  $n=192$ ; (2):  $n=195$ ; (3):  $n=199$ ; (4):  $n=189$ ; (5):  $n=187$ ; (6):  $n=197$ ; (7):  $n=189$ ; (8):  $n=188$ ; (9):  $n=194$ .  
(c) Percentages for items (3), (6) and (9) represent students who answered 'no'. All other items reflect the percentage of 'yes' responses.  
(d) Statistically significant at  $p<0.001$ , based on the asymptotic McNemar test for repeated measures dichotomous data.

### Teacher results

Almost all the teachers strongly agreed or agreed that the FSS sessions were suitable for their students in terms of age, literacy, numeracy, and social context (Table 4). They were resoundingly positive that students enjoyed participating and had improved their knowledge, attitudes and skills concerning nutritious foods. These strong results were reflected in the teachers' voluntary comments, such as:

This program provides so many benefits that it should be the next headline news report in tomorrow's paper! Not only does it teach children what healthy food looks like, it also teaches children the positives of eating healthily. It is all done in a fun way, and I cannot say how much I enjoyed it.



Great experience, particularly for children of a low SES context. Kids' first experience with healthy foods. Very engaged and excited for lesson. Excellent easy recipes. Positive and enthusiastic presenters. 10/10.

Very relevant to our students - many of whom live independently or have responsibility for providing meals for family.

A great experience for Indigenous male students and surprising how much they learnt and enjoyed today's session.

Made me realise some major gaps in my students' knowledge i.e. many didn't understand the differences between fruits and vegetables - yikes! So thanks for helping me to discover that and for making my kids so excited about cooking and healthy food. Very inspiring.

Table 4: Teacher responses post participation in FSS  
(SA=strongly agree, A=agree, D=disagree, SD=strongly disagree)

	Items	(n)	Teacher responses (%)			
			SA	A	D	SD
<i>Student impact</i>	The Food Sensations session:					
	Improved my students' knowledge about nutritious foods.	(178)	73.6	25.3	0.6	0.6
	Provided my students with skills to prepare nutritious foods.	(177)	76.8	22.6	0.6	-
	Helped improve student attitudes towards nutritious foods.	(177)	73.4	26.0	0.6	-
	Provided my students with experience of how to handle food safely.	(177)	75.1	24.3	0.6	-
	Provided my students with experience of how to choose nutritious foods.	(177)	70.6	29.4	-	-
	I think my students enjoyed taking part in today's class.	(176)	92.6	7.4	-	-
	The skills learnt in today's session will positively contribute to the health of my students.	(173)	72.3	27.2	0.6	-
	The activities were appropriate to my students':					
	Age	(176)	86.9	12.5	0.6	-
	Numeracy levels	(173)	74.6	24.3	1.2	-
	Literacy levels	(175)	70.9	28.0	1.1	-
Social context (e.g. cater for different cultures, location and food access)	(176)	77.8	22.2	-	-	
<i>Teacher impact</i>	The Food Sensations session:					
	Assisted me in meeting some of my requirements in terms of the Health and PE and/or other curriculum objectives/ learning outcomes.	(164)	69.5	30.5	-	-
	Helped improve my knowledge about how to teach children about choosing healthy foods.	(168)	61.9	36.3	1.8	-
	Motivated me to include more nutrition education in my teaching.	(166)	62.7	36.1	1.2	-

Highlighted my need for more professional learning in nutrition education.	(159)	37.7	39.6	20.8	1.7
I plan to use the Food Sensations support materials (e.g. recipe booklets, lesson plans) to deliver curriculum in my classroom.	(166)	61.4	37.3	1.2	-
I was satisfied with the communication and support provided by Foodbank WA in arranging today's session.	(173)	82.1	17.3	0.6	-

When asked whether the skills learned in FSS would positively contribute to their students' health, 99% of the teachers either strongly agreed or agreed that it would, with many reinforcing this in their open-ended comments and reporting that students were keen to apply their new skills and enthusiasm for cooking healthy meals at home:

The sessions are brilliant and have a lasting impact. We had parent helpers today that helped last year also, and they reported that their children...make recipes from last year's session at home on a regular basis.

The students really enjoyed the...session, and I know many of them were planning on buying the ingredients and making the recipes at home. It was wonderful to see children having a go at tasting food they probably wouldn't [normally] eat.

...The cooking experience was excellent, inspiring my students to not only try new skills but also be mindful of the healthy foods needed in their daily lives. Plus healthy foods can be tasty.

A very informative lesson and the resources were great. There will be a lot of children having a go at cooking for their families.

Students were fully engaged and successful in creating a variety of healthy meals. They have indicated they will make their own at home.

Teachers were also highly positive (i.e.  $\geq 98\%$  agree/strongly agree) about the impact of FSS on their own NE knowledge and practice, except concerning the need for more NE professional learning which had a lower agreement rate of 78%. In their open-ended comments, several teachers flagged their intention to use the FSS resources in future class activities:

Resources were great and looking forward to using the lesson plans.

Loved that the info was posted to individual teachers. Plan to use resources in our Year 3 health rotation for the rest of the semester.

I will be looking at the website for lesson ideas regarding healthy eating.

## Discussion

This study demonstrates that improvements in primary and secondary school students' nutrition knowledge and attitudes can be achieved after a single education lesson

facilitated by a person with nutrition expertise and training in classroom behaviour management. Student evaluations showed small but statistically significant increases in knowledge of healthy eating and nutrition after participating in one FSS lesson, except for in more remote locations where samples were too small to detect significant differences. Improvements in attitudes towards healthy eating were evident for both the primary and secondary student cohorts. Noteworthy changes were students being more likely to believe healthy homemade meals are easy to prepare and that they can easily make a healthy meal.

Teachers who participated in FSS endorsed the suitability of the content and resources for students across a range of ages, social contexts and levels of literacy and numeracy. The teachers reported that the hands-on cooking experiences, group discussion and sharing of foods prepared with classmates were highly motivating and empowering for students such that they were often keen to try the healthy recipes at home with their families. Importantly, the teacher feedback and results of the student evaluations concur with other studies that show maintaining a clear focus on a limited set of key behavioural messages (Puma et al., 2013) is effective even within a single lesson (Koch, 2016).

Whilst schools are already acknowledged to be an ideal setting for health promotion initiatives, the results of this study add value in that they both challenge the unrealistic expectations and perceived barriers that deter schools and teachers from implementing NE and highlight a realistic or pragmatic approach to NE in Australian schools. First, consistent with best practices in NE teaching strategies, the FSS lesson plans for all year groups were designed with behavioural targets and an experiential or hands-on component known to be associated with the largest effects on nutritional knowledge and healthy eating behaviours (Dudley et al., 2015; Koch, 2016; Murimi et al., 2018). Engaging activities, such as students preparing and sharing new foods or recipes and reflecting on the foods they typically eat and what they might do differently in future, were included to help develop student food literacy and self-efficacy to choose healthier foods. However, hands-on activities can present practical barriers for schools and teachers, including limited equipment, facilities, and budget for food preparation (Clarke et al., 2013; Diker et al., 2011; Ensaff et al., 2015; Lisson et al., 2016). External providers such as FSS or trained local providers can offer an immediate solution, but supply and cost, particularly in remote locations, may still be prohibitive for some schools. Investment in a set of basic equipment for classroom use (rather than specialist facilities) (Ensaff et al., 2015), like that used for FSS, may be the most economical investment for schools.

The second reality highlighted by this study is that a single experiential lesson can provide knowledge, develop cooking skills, build self-efficacy, and spark an interest that motivates children to seek a healthier diet. Teachers in our study reported immediate student intentions to practise their new food preparation skills at home. Certainly, these precursors of dietary change are part of the established change process for nutrition and food-based education (Contento, 2008) - made easier to act on in the short, medium or long-term by supportive school, family, and community environments (Chaudhary et al., 2020; Contento, 2008; Knai et al., 2006; Murimi et al., 2018; WHO, 2020, 2021).

Equipping students with the skills and resilience to counter the multitude of factors that can deter healthy food consumption in unsupportive environments presents a significant challenge (Chen et al., 2023; Ranjit et al., 2015). This reality has implications for planning NE lesson content, taking into consideration relevant behavioural targets and how to achieve and maintain them within prevailing student food environments. The FSS lessons, facilitated by trained nutrition professionals, provided opportunities for students to safely explore food choices and discuss how to procure healthy choices in their home, school and community settings.

A third reality challenging teachers and schools is the question of providing supportive food environments for healthy eating (Contento, 2008), such as outlined in best practice frameworks like *Health Promoting Schools* (WHO, 2021). Teachers and other school staff involved in NE express frustration at a perceived lack of interest and support by parents, providers and other stakeholders in reinforcing healthy eating within the home (Cho & Nadow, 2004) and local community (Clarke et al., 2013). Under such circumstances, focusing on the school environment may be the most manageable first step. Linking FSS NE with the SBP provides one example of not only providing a school environment supportive of classroom NE healthy eating messages but also involving parents and local community members (Hill et al., 2023) so that they are exposed to and learn from the educational messages. Consistent with the social learning theory applied in planning FSS, SBP helpers who observe what and how healthy foods are provided and see the positive responses from students may also be motivated to try new food behaviours. SBP resources such as posters, games, placemats and recipe books can provide additional links and reinforcement of classroom NE messages (Tartaglia et al., 2022).

The fourth reality is that implementing best practice school-based NE is often the most challenging when targeting children who would benefit the most (Dykstra et al., 2016; Mohajer & Earnest, 2010). The FSS intervention targets schools with students of high social and/or educational disadvantage, including those from isolated geographic areas, non-dominant cultures or linguistic backgrounds, and/or low-income families who often have the least access and capacity to support NE. As reported by teachers in this study, FSS sessions provided the first opportunity for some students to engage in food preparation and shared tasting activities. The universal appeal of food preparation activities was confirmed by teachers who noted the additional engagement of Indigenous boys and children from low socioeconomic backgrounds. Given these results and the identification of experiential NE as the most effective in achieving NE outcomes (Dudley et al., 2015; Murimi et al., 2018; Rush & Knowlden, 2014), food preparation and cooking classes should be the preferred format for NE in disadvantaged schools.

The final reality is that even if NE sessions are outsourced to programs such as FSS, classroom teachers have day-to-day contact with their students and therefore a critical role in reinforcing students' learning and commitment to healthy eating. Practice and feedback, reward and reinforcement are critical aspects of social learning theory that help to embed and sustain newly learned behaviours (Bandura, 1977). FSS provides additional online resources to support teachers in this role (Foodbank WA, 2023). The evidence from our study may help to reduce or remove barriers for classroom teachers/educators to deliver

NE with the knowledge that a targeted lesson using experiential learning can improve students' knowledge of, and attitudes towards, healthy eating and motivate behavioural intentions. Specific nutrition training for teachers (like that provided by Foodbank WA to health organisations in regional/remote communities) may encourage greater emphasis on NE within schools – particularly those that serve disadvantaged and remote communities. This is important since teachers have a pivotal role in the successful implementation of school-based health promotion policies and interventions (WHO, 2020). Indeed, the WHO recommends “school staff training in nutrition and health-related issues” as one of 26 essential criteria in the *Nutrition Friendly Schools Initiative* (WHO, 2020, p. 4).

A limitation of this study is that the primary and secondary student instruments were designed to be used for all FSS lessons rather than targeted to specific nutrition topics or lesson plans. This was deemed necessary to afford maximum flexibility for schools and reduce the administrative burden on Foodbank WA staff since paper-based pre-evaluation surveys were posted to schools and completed by students several weeks before the FSS visit. The nutrition topics delivered during the FSS sessions were selected from the suite of FSS lesson plans (Foodbank WA, 2023) according to the age group and social context of the school and prior participation in FSS. Not all food and nutrition topics were taught in each session, hence the results may reflect students' unfamiliarity with specific knowledge or concepts, such as how to interpret a food label.

The lack of a control or comparator group to help establish causality is a further limitation, however, this was not feasible within the terms of the FSS contractual evaluation requirements with schools. It was also not feasible to undertake longer-term follow-up studies to evaluate the retention of knowledge and attitude gains.

## **Conclusion**

This study demonstrates that single, well-planned, experiential NE sessions facilitated by trained nutrition professionals that engage all students in cooking simple, healthy recipes can be effective in improving students' knowledge and attitudes to nutritious foods and healthy eating. Importantly, hands-on cooking activities and sharing of prepared dishes are powerful means of engaging students of all ages in NE - without the need for specialist kitchen facilities. The modelling of successful NE lessons by experienced facilitators, and the ready availability of comprehensive lesson plans and free resources that are linked to relevant curricula, provide valuable support for teachers to incorporate ongoing NE into their classroom programming.

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