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**Cook Like A Boss: An effective co-created multidisciplinary approach to improving children’s cooking competence**

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**Abstract**  
Cooking interventions are emphasised as promising methods for changing children’s food-related preferences, attitudes and behaviours. However, criticisms remain, including relatively weak intervention designs; lack of validated tools, and limited underpinning theory. Therefore, this research aimed to assess the effectiveness of a theory-driven co-created children’s cooking intervention with underpinning rationale for the content, using a validated measure.  
‘Cook Like A Boss’ was a one week, controlled cooking camp style intervention. Thirty two children aged 10-12 years participated. The intervention was developed using the Cook-Ed model for planning, implementing and evaluating cooking programs and was underpinned by Social Learning theory and Experiential Learning theory. The intervention content was developed in a co-creation process with the research team, a chef and the children. The underlying developmental skills required for the recipes were assessed to ensure they were age-appropriate. Children completed pre and post measurements including perceived cooking competence. Process evaluations were also gathered.  
There was a significant increase in perceived cooking competence after the intervention (P<0.05) and a significant difference between the intervention and control group (P<0.001). Additionally, process evaluations found the intervention to have high fidelity and dose received and that it was received extremely positively.  
The ‘Cook Like A Boss’ children’s cooking camp was an effective multidisciplinary co-created intervention with a vulnerable group, e.g. children, guided by a model and underpinned by theory. The content was developed to ensure it was age-appropriate and achievable for the children. This approach could act as a template for future children’s cooking interventions.  

**Keywords**  
Cooking; Children; Intervention; Design; Co-creation; Developmental skills
1.0 Introduction

Obesity is a complex, chronic condition with many biological, social and environmental factors linked to its development that is now rising in childhood (Han et al., 2010; Sahoo et al., 2015). Obesity can have a severe impact on a child’s physical and mental wellbeing (Han et al., 2010; Sahoo et al., 2015). Despite the complex and multifactorial nature of this condition, the rise in childhood obesity has been partially attributed to dietary behaviours (Sahoo et al., 2015; Pandita et al., 2016). Nutrition education programmes that include cooking are strongly recommended by the World Health Organization as preventative strategies for childhood obesity (WHO, 2016). Cooking skills and the consumption of home cooked meals are associated with a better diet quality and health outcomes, including normal body fat percentage (Mills et al., 2017; McGowan et al., 2016; Wolfson and Bleich, 2015; Zong et al., 2016). Furthermore, cooking has been included by WHO as a strategy for both parents and children, as there is a reported decline in home cooking as well as cooking activities involving children (Smith and Popkin, 2013; Lang and Caraher, 2001; Lavelle et al., 2019). While the COVID-19 pandemic saw an increase in the inclusion of children in cooking and baking activities (Benson et al., 2021), it is unknown whether this trend will continue when there is a return to in-office working and a reduction in time again, previously identified as a key barrier to cooking (Lavelle et al., 2016). Therefore, it is essential to consider additional approaches for teaching children cooking skills outside the home environment.

Cooking interventions are emphasised as promising methods for changing children’s food-related preferences, attitudes and behaviours (Utter et al., 2017; Hersch et al., 2014). Research shows that learning cooking skills at younger ages is associated with positive dietary outcomes in adulthood and they retain these skills from adolescence to adulthood (Lavelle et al., 2016; Laska et al., 2012). Additionally, involving children in the cooking process is linked to an increased willingness to try food, in particular vegetables (Radtke et al., 2019; van Der Horst et al., 2014). However, criticisms relating to cooking interventions remain, including relatively weak intervention designs; specifically, a lack of control groups and validated measurement tools, as well as limited underpinning of theory in both adult and child interventions (Reicks et al., 2018; McGowan et al., 2017; Utter et al., 2017; Reicks et al., 2014; Hersch et al., 2014). Validated measurement tools are essential to properly assess the effectiveness of interventions and strengthen the findings in the research area. Increased confidence and self-efficacy are key contributors to engaging in cooking practices and repeating the behaviour, in both children and adults (Lavelle et al., 2017a; Garcia et al. 2016; Dixon et al., 2013; Wrieden et al., 2007; Caraher et al., 2013). The self-efficacy people have for a specific task, in this case cooking, contributes to their perceived competence. Perceived competence is a greater motivator to perform a behaviour than actual competence (Harter, 1978) and thus is an important aspect to consider and measure in interventions. Furthermore, an ‘everything but the kitchen sink’ approach (anything imaginable/a large number of items, whether needed or not) to designing cooking and food skills interventions has been highlighted (Wolfson et al., 2017). Interventions tend not to put forward a clear rationale as to why and how the content and specific cooking tasks are chosen. For example, chopping or cutting may be included within an intervention, but authors do not specify the rationale for such choice of skills.

Cooking interventions are implemented in the school environment to varying levels of success, partly attributed to the individual leading the sessions (i.e. they are more effective when led by a culinary professional instead of an already over-burdened teacher) (Adab et al, 2018; Jarpe-Ratner et al, 2016; Caraher et al, 2013). Additionally, school-based cooking
interventions tend to be limited to a few sessions, whereas, a greater number of sessions are associated with effectiveness (Cunningham-Sabo and Lohse, 2013). Despite the potential effectiveness of nutrition education intervention programmes that incorporate cooking sessions into the intervention design, it is rare for these interventions to include more than one cooking session per week (Utter et al., 2017; Hersch et al., 2014). There is limited research on the potential success of a ‘cooking camp’-style intervention where children take part in multiple cooking sessions per week (Williams et al., 2019). However, the findings of previous pilot cooking camp-style interventions are promising in terms of increasing children's food knowledge and behaviours (Burdett-Parker and Garden-Robinson, 2016) including cooking skills (Jacob et al., 2020). Furthermore, the ‘camp’-style of cooking intervention is mainly focused in North America and has not been implemented outside of this context (Williams et al., 2019; Burdett-Parker and Garden-Robinson, 2016; Jacob et al., 2020; Condrasky et al., 2007).

Therefore, this research aimed to assess the effectiveness of a theory-driven co-created children’s cooking intervention with underpinning rationale for the content (‘Cook Like A Boss’), using a validated measure of perceived cooking competence. A secondary aim of the project was to determine the extent of implementation using process evaluation methods.

2.0 Material and methods

2.1 Participants and ethical approval

Parents of potential participants were recruited through researcher networks, social media channels and university advertisements. Upon contacting the research team, parents were provided with further information on the study and consent form, which they returned to the research team if interested in taking part. Participants were eligible if they were aged between 10 and 12 years and had not progressed to second level school (before exposure to Home Economics, a potential bias for attitudes and preferences). Parents chose their preferred week of camp to suit their schedules (blind to intervention group or control group). Parents were made aware that their children were not obliged to take part and that they could withdraw their child at any time point, up to data analysis, without reason or consequence. Additionally, the children were made aware that they did not have to take part. They were informed about the camp by their parents and by the research team before completing their first survey. All children provided verbal assent before the surveys and on day 1 of camp. The camp was provided free to all participants. The research was conducted in accordance with the Declaration of Helsinki. Ethical approval was received from The School of Biological Sciences Ethics Committee, Queen’s University Belfast (0519/LavelleFB).

2.2 Intervention Design and Structure

The intervention was developed in line with the Cook-Ed model for planning, implementing and evaluating cooking programs (Asher et al., 2020) and was theoretically underpinned by Social Learning theory and Experiential Learning theory (Bandura and McClelland, 1977; Kolb, 1984), emphasising a hands-on approach. This approach helps to develop an initial interest and basic skills which then enables lifelong learning in an adaptive process in line with Experiential Learning theory (Kolb, 1984). The intervention was named ‘Cook Like A Boss,’ as the phrase ‘Like A Boss’ was a popular phrase amongst children and young people and applicable as it means to do something with confidence or authority. Children between
the ages of 10-12 years were targeted as their fine motor skills required for cutting, folding, catching, etc. are not progressing at normal developmental rates (Gaul & Issartel, 2016), and before exposure to formal Home Economics education, which could influence how they react to the intervention. Due to the ‘camp’ format of the intervention, the intervention ran in August 2019, at a local cookery school in Belfast, Northern Ireland. Sample size was determined in line with similar studies (Condrasky et al., 2007) and what was feasible within the facilities and budget constraints. The intervention was led by a chef with over 30 years’ experience, of which included cooking classes for children. The chef was supported by additional facilitators, known as ‘camp leaders’ to the children, with a minimum of 1:4 ratio of facilitators to children with one additional facilitator for monitoring of camp and in case of accidents. The facilitators were all food and/or health researchers with previous experience of working with children. They received one evening of training on camp content, logistics and cooking skill observation. They also received a facilities orientation before the initiation of camp. There was also an additional assistant from the cookery school who monitored the children cleaning and was able to assist with school appliances/equipment. The ‘camp’ intervention, similar to camps in this country, was for a number of hours, usually focused on a singular activity, e.g. a sport, with no overnight stays, i.e. the children returned home daily. ‘Cook Like A Boss’ was of one-week duration, three hours per day, with the children cooking two dishes in each session. This week was then repeated for the control/delayed intervention group (Week 2). The children worked in assigned pairs for four of the five days (the final day children chose their partner) to ensure all children were mixed in case of pre-existing relationships, with each child getting the opportunity to complete every skill. A sample structure of a camp day included the children signing in, entering the kitchen in their assigned pairs, and the chef announcing what was on the menu for the day. The chef and children then read through the recipe together, with the chef providing a demonstration of the first component of the recipe, followed by the children executing this component themselves. This demonstration and execution step was repeated until the recipe (and each recipe for the day) was completed. Finally, at the end of the day the children would sit together with the camp leaders to sample their cooking. The children were provided with a recipe booklet at the end of the camp week which included all the recipes they had prepared, for use at home.

2.3 Content Development

The intervention content was developed in a co-creation process with behavioural scientists, Home Economists and a Human Movement scientist, (forming the research team), in conjunction with the chef and the children involved in the camp (see Figure 1 for co-creation process). The co-creation process, a strong and active collaboration between the researchers and end users, the children in the current intervention, may enhance intervention effectiveness (Sanders and Stappers, 2008). While proxy end users are often used for children, e.g. their parents, due to the vulnerable nature of the target group, and intervention planning usually occurring before ethical approval is received, this intervention generated a strategy to include the children in the process. Initially, the research team and the chef discussed potential concepts, areas and skills to cover, with an agreement that the focus should be on the children’s enjoyment and include a variety of skills and vegetables. Four themed days were decided upon; ‘General introductory and knife safety,’ ‘Italian food-themed day,’ ‘Bakery day,’ and ‘Plant-based/Vegetable day,’ the full programme outline can be seen in Supplementary material. The final day (day 5) was reserved for the children’s input in order to increase ownership and enjoyment. For each themed day, the chef proposed potential recipes. Using procedural task analysis the recipes were deconstructed into each step of the method and into the underlying developmental skills, including fine and gross motor skills as well as numeracy, literacy and safety considerations (see Table 1 for example deconstruction). This was undertaken to ensure that the recipes were age-
appropriate in line with Dean et al. (2021) and to ensure a wide range of cooking skills were included. Suggestions were made by the research team and, subsequently, recipes were amended to encompass any additional skills required.

Table 1: Example Chicken Chowder Recipe deconstruction for cooking skills and motor skills

<table>
<thead>
<tr>
<th>Recipe</th>
<th>Instruction</th>
<th>Skills</th>
<th>Motor skills required for each skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 chicken breast (sliced)</td>
<td>Preparing</td>
<td>Chopping with a sharp knife</td>
<td>Forming radial palmar grasp with lateral prehension, forming a firm claw to grip food safely</td>
</tr>
<tr>
<td>1 shallot (diced)</td>
<td></td>
<td>Chopping with a sharp knife</td>
<td>Forming radial palmar grasp with lateral prehension, forming a firm claw to grip food safely</td>
</tr>
<tr>
<td>1 tbl of celery (chopped)</td>
<td></td>
<td>Measuring</td>
<td>Forming a radial palmar grasp or an open radial palmar grasp</td>
</tr>
<tr>
<td>1 clove of garlic (chopped)</td>
<td></td>
<td>Using an oven</td>
<td>Forming palm supinate grasp or inferior pincer grasp</td>
</tr>
<tr>
<td>120g bacon/bacon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>175g sweet potato (diced)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4 corn (routed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150ml chicken stock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150ml milk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 scallions (chopped)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coriander (chopped)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Toss chicken and bacon in flour</td>
<td>Mixing with hands</td>
<td>Forming caws and moving fingertips, moving hands open and closed, forming a palmar grasp</td>
</tr>
<tr>
<td></td>
<td>Add chicken and bacon to mincemeat</td>
<td>Scraping ingredients into pan&quot;</td>
<td>Forming radial palmar grasp with lateral prehension</td>
</tr>
<tr>
<td></td>
<td>Add oil, shallots, garlic and baby corn</td>
<td>Scraping ingredients into pan&quot;</td>
<td>Forming radial palmar grasp with lateral prehension</td>
</tr>
<tr>
<td></td>
<td>Cook for 3-4 mins</td>
<td>Stirring over heat</td>
<td>Forming radial palmar grasp</td>
</tr>
<tr>
<td></td>
<td>Add sweet potato</td>
<td>Scraping ingredients into pan&quot;</td>
<td>Forming radial palmar grasp with lateral prehension</td>
</tr>
<tr>
<td></td>
<td>Cover with stock</td>
<td>Pouring from a container</td>
<td>Forming an open radial palmar grasp and holding onto the container</td>
</tr>
<tr>
<td></td>
<td>Bring to boil and simmer for 10 mins</td>
<td>Adjusting temperatures&quot;</td>
<td>Forming palm supinate grasp or inferior pincer grasp</td>
</tr>
<tr>
<td></td>
<td>Add milk</td>
<td>Pouring from a container</td>
<td>Forming an open radial palmar grasp and holding onto the container</td>
</tr>
<tr>
<td></td>
<td>Simmer for 10 mins</td>
<td>Adjusting temperatures&quot;</td>
<td>Forming palm supinate grasp or inferior pincer grasp</td>
</tr>
<tr>
<td></td>
<td>Add scallions, corn and coriander</td>
<td>Scooping ingredients into pan&quot;</td>
<td>Forming hands together</td>
</tr>
<tr>
<td></td>
<td>Season with salt and pepper</td>
<td>Pouring from a container/ &quot;spreading&quot;</td>
<td>Forming an open radial palmar grasp and holding onto the container/ Rubbing fingertips together, forming pincer grasps/ Forming open radial palmar grasp and twisting wrists to use griller</td>
</tr>
</tbody>
</table>

To enable the children’s involvement in the process, the children were asked on day 1 of the camp about their favourite food and what they would like to learn. The team collated their suggestions and provided them to the chef. The chef then provided potential recipes and the team completed the deconstruction of the recipes for the skills involved and age-appropriateness. The inclusion of the children in the decision process resulted in two different main dishes being cooked by the different weeks of camp (e.g. Week 1: ‘Fakeaway’ Honey Chilli Chicken, Week 2: Popcorn chicken), however, both weeks covered all the same cooking skills.
2.4 Data collection and intervention assessment

Two weeks before the intervention began children attended the university and completed a pre-intervention survey, provided to the children using tablets. This was used as the ‘Pre-intervention’ time point (T1) for all the participants, regardless of which camp week they attended. The intervention group completed this survey again immediately after completing the cooking camp. This was used as their ‘Post-intervention’ time point (T2). The control/delayed intervention group completed their ‘Post-intervention’ (T2) survey at the beginning of the first day of the cooking camp before they took part in any cooking or food related activities. The control/delayed intervention group also completed the survey for a third time (T3), immediately after they completed the cooking camp, so that the effects of taking part in the intervention could also be determined for these children, see Figure 2 for overview of data collection time points.

Figure 1: Cooking camp intervention co-creation process
For accurate assessment, the children’s attention span, the questioning formatting and the clarity of the language are essential (Punch, 2002; Boyden & Ennew, 1997), therefore, validated or adapted validated measures were used where possible. Additionally, questions were presented to children in an engaging format e.g. were brightly coloured, included the camp logo, pictures and icons in response categories and the survey duration was approximately 10 minutes. Furthermore, surveys were completed using tablets to increase the ‘game-like’ feel of the survey (Punch, 2002; Mann & Tolfree, 2003). The surveys gathered data relating to the children’s attitudes, behaviours and knowledge of food, the measures included are detailed in section 2.4.1. Children’s prior cooking experience was assessed using the question ‘Do you help your mum/dad/other adult making the dinner.’ Children responded on a scale of 1 to 5, with 1 meaning ‘Always’ and 5 meaning ‘Never,’ scores were reverse coded for analysis so that a higher score indicated more frequent assisting. In addition to this, one parent (of each child participant) completed a survey at recruitment providing information on their sociodemographic characteristics. This was collected to understand the background of the participants.

2.4.1 Survey Measures

Perceived Cooking Competence

The main outcome of the intervention, children’s perceived cooking competence, was assessed using the validated CooC11 (Dean et al., 2021). CooC11 is an 11-item measure used to assess children aged 8-12 years on their perceived competence of their cooking skills, including skills such as chopping, peeling, weighing ingredients and using an oven. Children are shown illustrations of characters and asked whether they do the skill, if they respond yes, they are then shown two illustrations one of a ‘good’ performance of a skill and one of a ‘poor’ performance. The child is then asked which image they are most like on a five point Likert scale. The sequence of presentation of ‘good’ and ‘poor’ performance of a skill alternated, and scores were reverse coded where necessary so that a higher score indicated
a higher perceived competence. The score for each skill is then summed to create a total cooking competence score, with possible scores ranging from 0 - 55.

Food Exposure and Willingness to try

Food Exposure and Willingness to try were adapted from Birch and Sullivan (1991) and Morgan et al. (2010), previously used in a similar age group in Northern Ireland (Brennan et al., 2021). Children were presented with six images of vegetables and asked whether they had tasted the food before. Positive responses were coded as one and their scores were summed to give a Food Exposure score, with possible scores ranging from 0 to 6.

Additionally, children were asked either would they be willing to try the food or try the food again. Positive responses were coded as one and summed to create a Willingness to try score, with possible scores ranging 0 - 6.

Cooking Enjoyment

Cooking enjoyment was a researcher devised item based on previous studies (Lavelle et al., 2019; Lavelle et al., 2016). Children were asked to rate their agreement with four statements, ‘I have no interest in cooking,’ ‘I think cooking is fun,’ ‘Cooking is one of my hobbies, and ‘I cook whenever I can,’ on a scale of 1 to 5, with 1 meaning definitely disagree to 5 meaning definitely agree. Emoticons were used to help illustrate the meanings. The first item was reverse-coded and the items were summed to create a score for cooking enjoyment, with possible scores ranging from 4 - 20.

Spending time with a parent

Finally, children were asked to rate their agreement with the statement, ‘One of my favourite things about cooking, is spending time with a parent,’ on a scale of 1 to 5, with 1 meaning definitely disagree to 5 meaning definitely agree. This item was included as at this age, it is likely that most children’s exposure to cooking will have included parental involvement. This is to gather initial insights into whether it is this parent-child bonding time that the children find enjoyable rather than the cooking activity, as this element has been removed in this intervention.

2.5 Process Evaluation

Process evaluations were gathered in line with Saunders, Evans and Joshi (2005). Aspects in focus of this process evaluation include: fidelity – extent to which the intervention was delivered as intended, dose delivered – completeness of delivery, dose received – both ‘exposure’ and ‘satisfaction’, reach – participation rates, recruitment – procedures used to attract/retain participants and context – potential environmental influences (assessed during planning phases of the intervention). This data was collected by the experienced research team before the initiation of camp, e.g. recruitment and by the additional facilitator during camp for example using attendance sheets, the intervention content and whether all recipes and thus skills for the days were delivered. For the dose received (satisfaction) assessment, insights were provided from the intervention deliverers (i.e. the chef, assistant and camp leaders), the participants (children from week 2) and the participants’ parents. The intervention deliverers completed a brief researcher developed survey including items around perceptions of children’s skill level, learning and enjoyment for each week and about the camp in general for success, enjoyment, new skill acquirement and format. There were additional open ended questions that feedback could be provided. Children answered additional questions in their survey including rating the camp for enjoyment, taking part in the
type of camp again and open-ended questions for their favourite part and further feedback. All parents provided verbal feedback at the end of the week and were prompted to send written open feedback, which is summarised.

2.6 Data Analysis

IBM SPSS Version 26 was used to conduct all statistical analysis. All significance levels were set at <0.05. Descriptive statistics (mean and standard deviation [SD]) were used to summarise the demographics of the participants and their parents. Prior to data analysis, where necessary, items were reverse coded so that a higher score indicated a more positive or desirable response.

2.6.1 Intervention Assessment

A pre/post assessment was undertaken combining the data from the children in both weeks of the camp intervention. Paired-sample t-tests and Wilcoxon Signed Ranks tests were conducted on children's mean scores for the following measures: CooC11, Food Exposure, Willingness to Try, Cooking Enjoyment, and Spending Time with Parents. For this test, Data from T1 and T2 were used for children of Week 1 and data from T1 and T3 were used for children of Week 2 so that the effects of the intervention could be observed with a greater sample size. Changes in the same measures were analysed using ANOVA to compare the mean changes in measure scores between the Intervention and Control groups (Week 1 and Week 2 respectively). For these tests, T1 and T2 data were used for both groups. Cohen’s d was used to assess effect size of any significant differences, with meaning of effect size being d (.01) = very small, d (.2) = small, d (.5) = medium, d (.8) = large, d (1.2) = very large, and d (2.0) = huge (Sawilowsky, 2009).

2.6.2 Process evaluation assessment

Descriptive statistics were used to present data from the participants, participants’ parents and the intervention deliverers. The responses to qualitative questions posed relating to the children’s experiences of the cooking camp were collated for the evaluation to determine common themes by one researcher (COK), a second researcher checked themes for consistency with the data and inspected them for overlap (FL). These themes were not pre-determined but rather determined by the answers given by respondents.

3.0 Results

Each intervention group consisted of 16 children. Of the 32 children who participated, 25 were female and 7 were male. The demographics of the parents and children of both weeks can be found in Table 2.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Intervention (Week 1)</th>
<th>Delayed/control (Week 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (N)</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Participants</td>
<td>Mean SD</td>
<td>Mean SD</td>
</tr>
<tr>
<td>Age (years)</td>
<td>10.69 0.48</td>
<td>10.44 0.63</td>
</tr>
</tbody>
</table>

Table 2: Sociodemographic characteristics of the ‘Cook Like A Boss’ participants and their parents
Assisting an adult with dinner preparation* | 2.88 | 1.55 | 2.38 | 1.06

<table>
<thead>
<tr>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
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<tbody>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary School</td>
</tr>
<tr>
<td>Additional Training</td>
</tr>
<tr>
<td>Undergraduate degree</td>
</tr>
<tr>
<td>Postgraduate degree</td>
</tr>
</tbody>
</table>

* Scores coded so that 1 means 'Never' and 5 means 'Always'

3.1 Intervention Outcomes

Children's perceived cooking competence and Food Exposure significantly increased (P<0.05) from before to after the intervention. One of their favourite things about cooking-spending time with a parent, significantly decreased (P<0.05). There were no changes found for Child Cooking Enjoyment and Willingness to Try (Table 3).

Table 3: Intervention effect on children's perceived cooking competence and food related variables using paired samples t-tests and Wilcoxon signed ranks tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Possible Ranges</th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
<th>P</th>
<th>Cohen's d</th>
</tr>
</thead>
<tbody>
<tr>
<td>CooC11*</td>
<td>32</td>
<td>0 - 55</td>
<td>21.66(7.86)</td>
<td>26.13(8.89)</td>
<td>0.003</td>
<td>-0.56</td>
</tr>
<tr>
<td>Food Exposure</td>
<td>31</td>
<td>0 - 6</td>
<td>4.63(1.16)</td>
<td>5.00(1.13)</td>
<td>0.032</td>
<td>-0.41</td>
</tr>
<tr>
<td>Willingness to Try</td>
<td>31</td>
<td>0 - 6</td>
<td>5.53(0.67)</td>
<td>5.71(0.59)</td>
<td>0.145</td>
<td>-</td>
</tr>
<tr>
<td>Child Cooking Enjoyment</td>
<td>31</td>
<td>4 - 20</td>
<td>16.13(3.31)</td>
<td>17.00(2.45)</td>
<td>0.061</td>
<td>-</td>
</tr>
</tbody>
</table>
Spending Time with Parents

|       | 31 | 1 - 5 | 3.26(0.89) | 2.90(1.01) | 0.039 | 0.39 |

*CooC11 is a validated children’s perceived cooking competence measure including the 11 items: washing vegetables; stirring/mixing ingredients; mashing; measuring liquids; weighing ingredients; chopping; grating; peeling; using a tin opener; using the oven; and using the stove/hob. Meaning of effect size: d (.01) = very small, d (.2) = small, d (.5) = medium, d (.8) = large, d (1.2) = very large, and d (2.0) = huge (Sawilowsky, 2009).

Table 4 provides the results comparing the two groups (Intervention v control) which showed that there was a significant difference between the mean changes in CooC11, Food Exposure, Willingness to Try and Spending Time with Parents (p<0.05). For the measures where differences were significant, all changes were greater and more positive in the Intervention group, except for ‘Spending Time with Parents’, where a greater positive change was recorded for the Control group.

**Table 4: Comparison between the intervention and control group**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Possible Ranges</th>
<th>Change in means (post – pre) (SD)</th>
<th>P</th>
<th>Cohe n’s d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Intervention Group (N=16)</td>
<td>Control Group (N=16)</td>
<td></td>
</tr>
<tr>
<td>CooC11*</td>
<td>0 - 55</td>
<td>6.25(6.16)</td>
<td>-3.50(6.72)</td>
<td>0.000</td>
</tr>
<tr>
<td>Food Exposure</td>
<td>0 - 6</td>
<td>0.69(0.95)</td>
<td>-0.13(0.62)</td>
<td>0.007</td>
</tr>
<tr>
<td>Willingness to Try</td>
<td>0 - 6</td>
<td>0.31(0.60)</td>
<td>-0.19(0.75)</td>
<td>0.046</td>
</tr>
<tr>
<td>Child Cooking Enjoyment</td>
<td>4 - 20</td>
<td>0.63(2.60)</td>
<td>-0.25(2.14)</td>
<td>0.308</td>
</tr>
<tr>
<td>Spending Time with Parents</td>
<td>1 - 5</td>
<td>-0.63(0.96)</td>
<td>0.25(0.86)</td>
<td>0.011</td>
</tr>
</tbody>
</table>

3.2 Process evaluation results

Recruitment was undertaken through researcher networks, university channels and social media. This was an effective method for recruitment, as both intervention weeks had the maximum participants that could be facilitated.

The fidelity of the intervention was high, as it was delivered as intended, being delivered by a chef and assisted by ‘camp leaders.’ Additionally, all intended skills were covered and children had input into the content for both weeks. For the context, the cooking school was an appropriate teaching environment, as it had been designed and built as a purpose built teaching school that had the capacity (both physical and experience) for teaching children in an engaging manner. Additionally, its convenient location enabled easy attendance, with free parking for parents. While the camp leaders were there to assist and monitor children, they also encouraged a sense of fun and enjoyment for the children.
For dose received ‘exposure’ each week, all sessions were fully completed and the participation rates were high, with 30 of the 32 children taking part in all sessions (1 child missed a day due to illness and 1 child had a prior commitment). In addition, all children completed the final survey.

Regarding dose received, in terms of ‘satisfaction,’ the views of the participants, their parents and the facilitators are taken into account. The children’s responses to questions regarding their enjoyment of the camp were overwhelmingly positive, with every child indicating that they found the cooking camp either enjoyable (80%) or extremely enjoyable (20%), when asked to rate their experience. When asked whether or not they would like to take part in a similar camp again, every child (100.0%) selected ‘yes’. The children’s favourite elements of the camp included cooking (37.5%), baking (20%), the facilitators (camp leaders) (20%) and having fun with their friends (13.3%).

All parents provided positive verbal feedback, however, after prompting eight parents contacted the team after the intervention to offer feedback regarding the cooking camp. The most common comment was that their children enjoyed the camp (75%). Parents also commented that the camp was educational (37.5%) and improved their children’s interest in food (37.5%), more eager to cook (25%) and more open to trying new foods (12.5%). Other comments left by parents included their children being eager to return to the camp (25%), loving the food they cooked (12.5%) and enjoying the pre-camp assessment (12.5%).

When asked to report on children’s experiences of the camp, the intervention deliverers (chef, assistant and facilitators) comments were positive, with every evaluator agreeing to an extent or definitely agreeing that the children enjoyed the camp, tasted new foods and learned new skills. All agreed to an extent or definitely that the camp was successful, beneficial to children and an appropriate format for children to learn about cooking. The majority of deliverers (88.9%) agreed that the children were interested in what they were doing throughout the camp. The most frequent comment provided by the deliverers was that the camp was enjoyable (55.6%).

4.0 Discussion

To the best of our knowledge, this is the first children’s cooking intervention guided by a model specifically for the planning, implementing and evaluating of cooking programmes (Asher et al., 2020), as well as being underpinned by theory and using a co-creation process in its development. In addition, the intervention had a strong rationale for the content development to ensure it was age appropriate and thus achievable for the children (Dean et al., 2021). In addition, the camp was extremely positively received by the participants and their parents. The thorough design of the intervention resulted in an effective children’s intervention for improving children’s perceived cooking competence, a motivator and determinant for repeated behaviour. Perceived competence is a key psychological factor when engaging in cooking and food preparation seen in adults and initial evidence for this in children (Dixon et al, 2013; Garcia et al, 2016; Lavelle et al, 2017a; Lavelle et al, 2017b), with perceived competence having more influence on performance than actual competence (Harter, 1978). While children had some previous experience with assisting with dinner preparation, both groups averaged less than the midpoint of ‘sometimes,’ indicating limited previous experience. Participation in the cooking intervention ‘Cook Like A Boss’ improved children’s perceived cooking competence and had a very large effect size, meaning it had a real-world impact. In accordance with Social Learning Theory (Bandura, 1994), perceived competence can be improved through mastery experiences (those which require the
individual to take part in difficult tasks and overcome obstacles through perseverance),

vicarious experiences provided by social models, social persuasion and by reducing

individuals’ stress reactions towards challenging situations. ‘Cook Like A Boss’

encompassed each of these strategies for improving self-efficacy. The children took part in

mastery experiences as they were faced with the challenging task of preparing recipes with

ingredients they had never been exposed to or cooked with before, and did so repeatedly

throughout the camp. In the camp the children tackled these challenges within a group of

their peers and were led by supportive facilitators who provided guidance and words of

encouragement when needed. The process evaluations also highlight the importance of the

facilitators, one fifth of the children reported them as one of their favourite parts of the

 camps.

‘Cook Like A Boss’ had a significant impact on exposure to a variety of vegetables with a

large effect size. Improving exposure to vegetables has been linked to increased

consumption (Osborne and Forrestell, 2012; Lakkakula et al., 2010), which has been

associated with lower BMI, blood pressure and waist circumference in adult life

(McNaughton et al., 2007; Ndanuko et al., 2016). Repeated exposure to vegetables has

been highlighted as an effective method of improving habitual consumption of this food

group (Reinaerts et al., 2007). This was another key element of the intervention, with

vegetables being used in each day of the camp, with the exception of the baking day where

fruits were included in the recipes. As well as improving the children’s exposure to

vegetables, taking part in ‘Cook Like A Boss’ also significantly improved their willingness to

try different vegetables in comparison to the control group, which was also noted by the

parents.

It is suggested that showing children foods (Heath et al., 2011), allowing them to interact and

play with foods (Coulthard and Sealy., 2017) and being involved in the cooking process (van

der Horst et al., 2014) can improve their willingness to try foods. These were all elements of

the intervention as the children spent the day preparing food before eating together, where

they were encouraged to touch, smell and taste the ingredients. Exposure to a range of

different foods is essential to improving children’s willingness to try new foods and reducing

neophobic responses (Birch et al., 1987). These negative attitudes towards foods are

reported to increase with age (Cole et al., 2017), thus targeting a child’s willingness to try

foods is even more important at a young age to ensure they eat a balanced, healthy diet. An

additional element of the intervention which may have positively influenced the children’s

Willingness to Try scores was the final activity of each day’s session – sitting down to eat

together. Social modelling has been identified as a primary determinant of eating behaviour

and food choice (Nisbett and Storms, 2017). Whilst social modelling has been shown to be

less effective for the influencing of healthy food consumption, children’s willingness to try

foods such as vegetables is increased when eating with their peers and adults, whether

these adults be familiar or unfamiliar to them, with this effect being sustained even after a

single exposure (Pliner and Mann, 2004; Cruwys et al, 2015).

Interestingly, the ‘Cook Like A Boss’ cooking camp significantly reduced children’s

enjoyment of spending time with their parents while cooking. However, the reduction in the

mean score of this measure may not be a wholly negative result. Children were asked to rate

how strongly they agreed with the statement ‘One of my favourite things about cooking is

spending time with a parent’. It may not be that the children no longer enjoyed spending time

with their parents – it may be that through taking part in the camp, the children discovered

new aspects of cooking which they enjoyed more. Some comments left by participating

children stated that they enjoyed the cooking and baking processes as well as trying new

foods and spending time with their friends, any of which could have become these children’s
favourite aspects of cooking rather than spending time with their parents. Additionally, before
camp, parental involvement may have been the norm for any cooking activities. Future
research should assess the effect of a parent-child cooking intervention on enjoyment of
spending time with a parent.

The process evaluations indicated that this was a very effective and acceptable format for
children to learn cooking skills. All children found the camp enjoyable and stated they would
like to take part again, a positive indicator for continued learning in line with Experiential
Learning Theory (Kolb, 1984). Many of the participating children had not taken part in much
cooking prior to completing the camp, due to having little interest in the activity. Previous
studies have shown that taking part in activities which evoke curiosity can improve
enjoyment in previously negatively-viewed activities (Isikman et al., 2016). Key barriers
identified to engagement in learning are a lack of enjoyment (Wolfson et al., 2016) and rigid,
serious teaching (Hernik and Jaworska, 2018). Removing these barriers was imperative to
the intervention’s success in improving cooking enjoyment, hence a chef with experience
working with children in fun and engaging sessions was recruited to facilitate the
intervention. Other elements of the intervention which aimed to improve their enjoyment
were involving the children in choosing recipes and having the children work in pairs. The
improvement of children’s cooking enjoyment is a success of the intervention as greater
enjoyment of leisure-based physical activities is shown to positively influence engagement
(Craike et al., 2010), hence this may also improve engagement in cooking. Enjoyment of
cooking is a significant psychological factor which influences diet quality (Chen et al., 2012),
particularly when individuals learn to cook from a young age. Child learners show more
positive attitudes towards food in later life compared to those who learned to cook as adults
(Lavelle et al., 2016). Not only is increased enjoyment associated with higher diet quality and
positive food and cooking attitudes, a dislike of cooking has also been associated with fast
food consumption and ultimately a poorer diet quality (Dave et al., 2009). It is therefore
imperative that cooking interventions targeting children make efforts to improve not only their
knowledge and cooking ability, but also their enjoyment of cooking.

Additionally, the process evaluations showed that children learned new cooking skills. Both
parents and camp leaders proposed that the children learned new skills and some of the
children’s favourite parts of the camp were the cooking and baking. The intervention content
was developed to be age-appropriate to ensure it was achievable for children, by
deconstructing the cooking skills for the underpinning developmental skills in line with Dean
et al. (2021). This allows the maximum opportunities for children to succeed in learning and
enhances opportunities for enjoyment through their learning of these skills to a level where
they are competent enough to perform the skill. This highlights that the deconstruction of
cooking skills and mapping to developmental skills is an effective approach for intervention
development. The positive intervention outcomes and process evaluations show that
the ‘Cook Like A Boss’ intervention is an effective intervention for teaching children cooking
skills and could act as a template for future children’s cooking interventions. Additionally, as
this ‘camp’-style of intervention is not commonly used in Europe, this study highlights the
potential impact of using this style of intervention.

4.1 Strengths and Limitations

Key strengths to this research include the multidisciplinary approach, the thorough content
development and the use of a validated measure. A significant strength of this research is
the co-creation of the intervention including participant input. A day was left open for the
children to have their input on what they would like to learn, increasing their ownership of the
intervention. By gathering these insights on the first day, it allowed time for the researchers to collate their suggestions, the chef to propose potential recipes and the researchers to conduct the procedural task analysis in line with the other days. This may be a beneficial step-strategy to include vulnerable groups in the co-creation process for interventions across disciplines e.g. 1) design the intervention with an open ‘space’ for participant input; 2) receive ethical approval; 3) first day of intervention gather participant insights for what they would like to learn/receive from the intervention; 4) collate insights, determine content from suggestions ensuring it is appropriate and safe.

While there are a number of strengths to this study, some limitations must be addressed. Due to the facilities available, the camp was limited to a small sample size. While in line with other cooking camp interventions (Condrasky et al., 2007), as this is an emerging research area, increased funding, especially outside a North American context, would enable larger randomised controlled trials to be completed and provide a larger number of children with the opportunity to learn. In addition to larger sample sizes, a greater number of boys should be recruited for these interventions. The research team did not discriminate on gender and the camp was filled on a ‘first come first served’ basis. Future interventions could actively target boys for recruitment to these interventions to counteract the gender imbalance and as boys may have less experience with cooking and more negative attitudes towards cooking. This may be due to cooking generally being traditionally perceived as a ‘woman’s activity’ by both men and women (Beagan et al, 2008). Studies in gender roles have shown that young girls feel they are expected to cook more than boys, with women commonly feeling it to be their responsibility to learn to cook (Mills et al, 2017; Martin Romero and Francis, 2019). However, teaching boys cooking skills may have additional benefits, as fine motor skills are required for cooking skills and research into the effect of sex on motor skills suggests that girls’ fine motor skills outperform boys’ at very young ages (Kokštejn et al., 2017). Future studies should investigate whether teaching children, and in particular boys, cooking skills can increase their motor skills. While a wide range of children were recruited, some children may have had existing relationships when entering the camp, which may have biased their enjoyment levels. However, researchers addressed this to a degree by assigning partners to the children and mixing children so that they were not partnered with anyone they had previously known. Additionally, by using university channels for recruitment, this may have created some bias in the sample as the participant parents are highly educated. Furthermore, while all parents provided verbal positive feedback only a few parents provided written feedback when prompted, which may add some bias in these results.

5.0 Conclusions
The ‘Cook Like A Boss’ children’s cooking camp was an innovative multidisciplinary co-created intervention, guided by a model for planning, implementing and evaluating cooking interventions, and was underpinned by psychological theory for learning. The content was developed to ensure it was age-appropriate and achievable for children, by mapping the cooking skills to developmental skills. It was shown to be effective for increasing children’s perceived cooking competence using a validated measure and process evaluations highlighted great fidelity and satisfaction in the camp by the participants. Additionally, a co-creation process for including vulnerable groups, e.g. children is highlighted. The ‘Cook Like A Boss’ approach could act as a template for future children’s cooking interventions.
The authors are grateful for the excellent facilitation of the camp by Chef Stephen Jeffers, Lisa and Katie Jeffers. Additionally, the authors would like to thank the participants and their parents that took part in the research. The authors would like to thank Lucy Patterson (@lucy_graphicdesigner) for her design work.

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Data Availability

Data collected is not publically available due to ethical approval. Data may be made available from the author with a formal data sharing agreement and upon further ethical approval.
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