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The Effect of a Youth Cooking Intervention on Nutrition Knowledge and Healthy Eating Behaviors among 4th & 5th Graders Attending Title I Schools

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by

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Childhood obesity rates have dramatically increased since the 1980's. This has become major public health concern because children who are overweight or obese are more likely to have obesity-related health issues and are more likely to be overweight or obese as adults. Obesity is also associated with poor dietary habits. Currently, children have dietary patterns that are low in fruits, vegetables, and whole grains. In addition, many Americans lack the knowledge on how to prepare healthful meals and because of this there is a lack of a meal preparation knowledge being transferred to children. To help address these issues it has been suggested that there is a need to teach youth not only nutrition knowledge but also basic cooking skills.

The objective of this study was to examine the impact of a 12-week afterschool cooking and nutrition club on youth nutrition knowledge, eating behavior and self-efficacy, and cooking attitude and self-efficacy among 4th and 5th grade students attending two Title I elementary schools. A secondary objective was to evaluate the novel healthy plate photo to assess youths' nutrition knowledge.

After participating in the WeCook program, 84.1% of youth reported they really liked to cook and 56% reported they could read a recipe by themselves. Youth significantly increased their knowledge about why breakfast is important and healthy snack options. At post-intervention there was a significant increase in the healthy plate photo scores from pre- to post-intervention with 55.1% of youth scoring the maximum

score. Finally, mixed results were seen for healthy eating behaviors and self-efficacy. Further research is needed to understand the effects cooking and nutrition programs have on youth participants related to nutrition knowledge, healthy eating behaviors and self-efficacy, and cooking attitude and self-efficacy.

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CHAPTER 1
Introduction

Since the 1980's the rates of childhood and adolescent obesity has increased dramatically in the United States (U.S.). Currently, 17% of children and adolescents aged 2 – 19 years old, of all ethnic groups are obese (Ogden et al., 2016). This high percentage of obese children and adolescents is a major public health concern because of the negative health consequences associated with obesity. Children and adolescents who are obese are more likely to have poorer health status, lower emotional functioning (Halfon, Larson, & Slusser, 2012), and are more likely to be overweight or obese as adults (Singh, Mulder, Twisk, van Mschelen, & Chinapaw, 2008).

Associated with obesity are poor dietary habits (Cutler, Flood, Hannan, Neumark-Sztainer, 2011). Currently, children and adolescents in the U.S. consume diets that are high in refined grains, solid fats, and are low in vegetables, fruits, whole grains, and dairy (2015 – 2020 Dietary Guidelines). Furthermore, it has been reported that 75% and 98% of male and female youth aged 9-13 years old, do not meet recommendations for fruits and vegetables (National Cancer Institute [NCI], 2015). Additionally, dietary patterns differ among youth based on income level and minority status. Evidence suggests that low-income, minority youth consume lower amounts of fruits, vegetables, and whole grains and consume higher amounts of high fat foods compared to youth from high-income families (Ball et al., 2009; Kant & Graubard, 2006; Christiansen, Qureshi, Schaible, Park, & Gittelsohn, 2013).

Mounting evidence suggests that poor dietary habits are linked to insufficient cooking knowledge and lack of cooking at home (Guthrie, Lin, Reed, & Steward, 2005). Since the 1960's, Americans are spending less time cooking and have increased their

consumption of convenience and takeout meals (Smith, Ng, & Popkin, 2013). In addition, it has been suggested that Americans lack the knowledge on how to buy and prepare healthy foods (Nelson, Corbin, & Nickols-Richardson, 2014). With these shifts in culinary practices there may be a decrease in the transfer of cooking knowledge to youth. As a result, youth may not gain the proper skills needed to be able to prepare and cook healthy meals by themselves (Nelson et al., 2014).

To address these issues, policy makers, researchers, and food and nutrition practitioners have suggested that Americans need to be educated on food preparation and cooking skills (Nelson et al., 2014). Cooking programs among adults and adolescents have been effective in improving food-related attitudes and behaviors; however, there is limited evidence of the effect in youth (Hersch, Perdue, Ambroz, & Boucher, 2014). Recently, more researchers are focusing on cooking programs for youth through in-school curriculum or afterschool programs (Hersch et al., 2014). Results from these studies showed that youth cooking programs improved fruit and vegetable intake (Yin, Moore, Johnson, Vernon, & Gutin, 2012), and positively influenced food related preferences, attitudes, and behaviors (Hersch, et al., 2014). Additionally, cooking programs may be of greater need among youth from underserved, low income, and minority families. Youth from these families typically have less food preparation skills and lower self-efficacy for food preparation compared to white counterparts (Woodruff & Kirby, 2013). However, there is still limited evidence regarding program impacts on youth's nutrition knowledge, healthy eating behaviors and self-efficacy, and cooking attitude and confidence.

Furthermore, researchers face challenges while working with low-income and minority youth, particularly in the area of data collection. Many studies assessing nutrition knowledge among youth have relied on self-reported data collected with questionnaires (Burrows, Lucas, Morgan, Bray, & Collins, 2015; Cunningham-Sabo & Lohse, 2013; Davis, Ventura, Cook, Gyllenhammer, & Gatto, 2011). This method of data collection may be problematic because many low-income and minority youth are less likely to be proficient at reading than high-income, non-minority youth (National Center for Education Statistics [NCES], 2016). Therefore, there is a need to develop assessment models that allow youth from all backgrounds to demonstrate changes in knowledge. For this study, a novel photographic method, the healthy plate photo (HPP), was developed to assess changes in youths' nutrition knowledge. To our knowledge, no nutrition and cooking study has used a photographic method for evaluation of nutrition knowledge.

As a result, the objective of this study was to examine the impact of a 12-week afterschool cooking and nutrition program on youth nutrition knowledge, eating behavior and self-efficacy, and cooking attitude and self-efficacy among 4th and 5th grade students attending two Title I elementary schools. A secondary objective was to evaluate the novel HPP created to assess youths' nutrition knowledge. The hypothesis was that youth participants will have a positive change in nutrition knowledge, healthy eating behavior and self-efficacy, and cooking attitude and self-efficacy from pre- to post- assessment after the 12-week afterschool intervention.

CHAPTER 2
Literature Review

Dietary Trends

Current Dietary Trends

A recent study found that only 20% of Americans meet current U.S. Department of Agriculture (USDA) guidelines for a healthy diet (Smith, Ng, & Popkin, 2013). Data from the 2007 – 2010 National Health and Nutrition Examination Surveys (NHANES) demonstrated that Americans age one and older consume less than the recommended amount for fruits (75%) and vegetables (87%) (NCI, 2015). In addition, 86% of Americans consume more than the recommended amount of energy from solid fats and added sugar (NCI, 2015).

Studies show children and adolescents also consume diets high in refined grains, solid fats, and are low in fruits, vegetables, whole grains, and dairy (2015–2020 Dietary Guidelines for Americans, 2016). According to data from the 2007 – 2010 NHANES, 75% of male and female youth aged 9 – 13 years old do not meet the recommendation for fruit and 98% do not meet the recommendation for vegetables (NCI, 2015). In addition, approximately one-third of youth consume two or more sugar sweetened beverages per day (Kit, Fakhouri, Park, Nielsen, & Ogden, 2013). Ninety-eight percent of youth consume snacks which comprise almost 27% of their total calories (Piernas & Popkin, 2010). Furthermore, from 1977 – 2006, youth's daily energy intake has increased 175 kilocalories per day (Poti & Popkin, 2011).

Youth Food Choices.

Previous research has found that youth food choices are significantly similar to their parent's choices (Kral & Rauh, 2010), with parents having the largest influence on their youth's eating behaviors (Ventura & Burch, 2008). Reasons for this include that parent's model eating behaviors and food choices and create youth's eating environment (Kral & Rauh, 2010). It has also been reported that parents who set eating rules that

encourage healthy eating and limit the consumption of unhealthy foods can have a positive impact on their child's diet (MacFarlane, Crawford, Ball, Savige, & Worsley, 2007). Research suggests that parental support for a healthy diet and increased availability of fruits and vegetables significantly increases the consumption of these foods among youth (Ranjit, Evans, Springer, Hoelscher, & Kilder, 2015). In multiple studies, parents have reported that eating fruit was easily accepted by youth, but faced challenges with vegetables (Nepper & Chai, 2017; Poti & Popkin, 2011). Youth food choices may also be influenced by how often they are exposed to food, with repeated exposure to foods being shown to increase the likelihood of consumption (Kral & Rauh, 2010).

However, food choices have been shown to be different among youth of different racial and socioeconomic status (SES). Among racial groups, white youth have significantly higher availability and accessibility of healthy foods in the home, greater parental support of a healthy diet, and consume more breakfast at home compared to Black and Hispanic youth (Ranjit et al., 2015). Youth with lower SES are more likely to have home environments that are not supportive of healthy eating compared to high SES youth (MacFarlane et al., 2007). In a study by Ball et al. (2009), adolescents whose mother's had low education reported lower levels of self-efficacy for increasing fruit intake and reducing junk food consumption. Evidence suggests that low-income, minority youth consume lower amounts of fruits, vegetables, whole grains and consume higher amounts of high fat foods compared to youth from high-income families (Ball et al., 2009; Kant & Graubard, 2006; Christiansen et al., 2013).

Obesity among Youth

Among children and adolescents, poor dietary habits are associated with the likelihood of being overweight or obese (Cutler, Flood, Hanna, & Neumark – Sztainger, 2011). Since the 1980's, obesity in children and adolescents 2 – 19 years old has increased from 10% to 17% (Ogden et al., 2016) with 31.8% being overweight or obese (Ogden et al., 2012). This high rate of obesity among children and adolescents is a major public health concern for various reasons. First, overweight or obese children are more likely to be overweight or obese as adults (Singh et al., 2008). Additionally, greater weight status has been associated with negative health outcomes including poorer health status, lower emotional function, school related problems, and comorbidities such as diabetes, heart disease, and attention deficit hyperactive disorder (Halfon, et al., 2012).

Weight status among youth is also not consistent among different demographic groups. In youth, weight status has been found to significantly vary according to race, ethnicity, and SES (Ogden et al., 2012). As of 2011 – 2014, 21.9% of Hispanic and 19.5% of non-Hispanic black children and adolescents were obese compared to only 14.7% of non-Hispanic white children and adolescents (Ogden et al., 2016). There is also an inverse relationship between head of household's education level and the prevalence of obesity among youth (Ogden, Lamb, Carroll, & Flegal, 2010). Youth from households headed by individuals with a high school degree or less were more likely to be obese compared to youth from a household headed by an individual with a greater degree (Ogden et al., 2016). Similarly, as income level increases the prevalence of obesity in youth decreases (Ogden et al., 2010) with the lowest childhood obesity rates among the wealthiest 20% of families (Cunningham, Kramer, & Narayan, 2014). In 2009 – 2010,

15% of low-income youth were obese compared to only 8.5% of high-income youth (Rossen & Schoendroff, 2012).

Cooking and Food Preparation

Cooking trends in the U.S.

Over the past five-and-half decades the way Americans cook has changed. Since the 1960's, Americans have decreased the amount of time spent cooking and have increased the amount of convenience and takeout meals regardless of income group (Smith, Ng, & Popkin, 2013; Wang & Beydoun, 2007). Along with the decreased time spent cooking, Americans spend less time preparing food with roughly half cooking on any given day (Smith et al., 2013). It was also suggested by the 2006 Keystone Forum Report, that Americans lack the knowledge on how to buy and prepare healthy meals (Nelson et al., 2014). Trends have shown that the amount of time men spent cooking has increased while the amount of time women spent cooking has decreased (Wang & Beydoun, 2007). Potential reasons for this shift include the increase in women in the workforce, amplified perception of time scarcity, societal demands, lack of cooking skills, and lack of food preparation knowledge (Reicks, Trofholz, Stang, & Laska, 2014). It has also been suggested that declines in cooking may lead to less healthy food options available in the home (Nelson et al., 2014). With parents spending less time preparing and cooking meals there may be a decrease in the transfer of cooking knowledge to children (Nelson et al., 2014).

Even with Americans spending less time cooking, parents would like to have their children help prepare meals, but often do not have their children help because of the time commitment of teaching them and the mess involved (Woodruff & Kirby, 2013).

However, evidence suggests that children and adolescents are helping their parents prepare and cook meals at home. The majority of adolescents reported helping prepare meals while half reported they helped grocery shop (Laska, Larson, Neumark-Stainzer, & Story, 2011). In one Canadian study by Chu et al. (2011), researchers found that 30% of youth helped with preparing a meal once daily with older youth more likely to help than younger youth (Woodruff & Kirby, 2013). Food preparation skill and self-efficacy level also appears to differ between gender and race. Female and white youths had more food preparation skills than their male and non-white counterparts (Woodruff & Kirby, 2013). In addition, white youth had greater self-efficacy for food preparation skills compared to non-white youth counterparts (Woodruff & Kirby, 2013). Research suggests that helping to prepare foods during adolescence has also been shown to continue into adulthood (Nelson et al., 2014).

Youth Cooking and Fruit and Vegetables

There is limited research regarding the effect of cooking skills on nutrition knowledge and eating behaviors among youth. Researchers have found that adolescents who helped prepare meals were more likely to make healthier food choices compared to those who did not engage in meal preparation (Larson, Story, Eisenberg, & Neumark-Sztainer, 2006). Helping with meal preparation was positively associated with fruit consumption among males and positively associated with both fruit and vegetable consumption among females (Larson et al., 2006). Youth who help prepare meals have been shown to have greater fruit and vegetable preference, self-efficacy for healthy eating, and a healthier diet profile (Woodruff & Kirby, 2013).

Cooking programs among adults and adolescents have been found to be effective in improving food-related attitudes and behaviors; however, the evidence of this effect in youth is still emerging (Hersch et al., 2014). Cunningham-Sabo and Lohse (2013) found that youth who participated in a cooking intervention, had increased fruit and vegetable preference, improved cooking attitude and self-efficacy compared to youth who did not participate in the intervention. It was also reported that the greatest gains for improved cooking attitude and self-efficacy were found among participants that had no prior cooking experience and in boys (Cunningham-Sabo & Lohse, 2013). Similarly, Caraher, Seeley, Wu and Lloyd (2013) found a significant increase in cooking confidence in youth who participated in a cooking program. Youth cooking programs have also been shown to increase fruit intake (Yin et al., 2012) and change youth's self-efficacy for fruit and vegetable preparation and consumption (Burrows, Lucas, Morgan, Mary, & Collins, 2015) Finally, cooking programs have also been shown to increase youth's willingness to try new foods when they had helped prepare them (Gibbs et al., 2013).

Traditional and Novel Assessment Models

Traditionally among many youth cooking and nutrition programs, questionnaires have been used to assess nutrition knowledge among participants (Burrows et al, 2015; Cunningham-Sabo & Lohse, 2013; Davis, Ventura, Cook, Gyllenhammer & Gatto, 2011). Questionnaires, a quantitative form of data collection, provide researchers with convenience, reliability, and validity. Researchers can use previously developed questionnaires that have been repeatedly tested and found reliable and valid among their target population. In return, researchers can statistically determine the effects a program may have on its participants.

However, researchers face challenges with using questionnaires among many populations, especially among low-income and/or minority youth. While questionnaires are developed for a target population, among low-income youth this may be harder to complete for a variety of reasons. First, these youth may not be at the appropriate reading ability level. It has been reported that low-income and minority youth are less likely to be proficient at reading than high-income and non-minority youth (NCES, 2016), potentially making questionnaires too difficult for them to read and understand. In addition, these youth may also be English Language Learners (ELL) which would make English based questionnaires harder for them to read and comprehend.

Because of these challenges, there is a need to create alternative assessments for youth. Researchers have typically used qualitative methods as alternative assessments such as interviews, focus groups, and observations to collect data. Unlike quantitative methods, qualitative methods focus more on the lived experiences of participants (Creswell, 2013). However, like quantitative methods, qualitative methods have limitations, with the most significant being the amount of time needed to properly collect and analyze data (Creswell, 2013). Therefore, there is a need to create alternative assessment models that are developmentally appropriate and are time efficient.

For this particular study the HPP was developed using USDA MyPlate to assess the change in nutrition knowledge among youth participants. To our knowledge, no nutrition and cooking study has used a photographic method for evaluation of nutrition knowledge. However, the photographic method has been used in studies for dietary recall (Matthiessen, Steinberg, Lucia, & Kraiser, 2011). To validate this method, researchers have compared photographs of meals to traditional dietary recall methods including 24-

hour dietary recall and weighed food records (Matthiessen, Steinberg & Kaiser, 2011; Wang, Kogashiwa, & Kira, 2006; Martin et al., 2006).

4-H and Children, Youth, and Families at Risk

The 4-H Youth Development Program is part of land –grant universities' (LGU) Cooperative Extension Services and the USDA that provides youth outreach programs focused on positive youth development (National Institute of Food and Agriculture [NIFA], 2016). It is the largest youth development organization in the U.S. and currently serves approximately six-million youth through local 4 – H clubs, school and afterschool programs, camps, and special interest groups (NIFA, 2016). The four H's stand for head, heart, hands, and health and are the foundation for many of the programs (4 – H, 2016). These programs focus on areas such as health, science, agriculture, and citizenship while using the experiential learning model, or hands on learning, to encourage youth participants to take on leadership roles (4 – H, 2016). With strong connections to LGU and the USDA, programs are research and science based and have made 4 – H an excellent example of positive youth development (NIFA, 2016).

In 1914, the Smith – Lever Act created the Cooperative Extension Service as a partner with the USDA, LGU, and local governments (NIFA, 2016). Because of this relationship, federal funding is available for LGU to conduct 4 – H programming (NIFA, 2016). One example of this federal funding is the Children, Youth, and Families at Risk (CYFAR) grant program. CYFAR is a USDA funded grant program that provides funding to LGU Extension services for community based programs (NIFA, 2016). The mission of CYFAR is to deliver educational programs that will equip youth who are at

risk of not meeting basic human needs with necessary skills to live positive, productive, and contributing lives (NIFA, 2016).

CHAPTER 3
Methodology

Study Design

WeCook: Fun with Food and Fitness was a 12-week afterschool cooking and nutrition intervention program focused on cooking activities and nutrition education. The intervention took place at two Title I elementary schools through Community Learning Centers (CLC) in a Midwestern city from January 2016 to May 2017. Because of the 12-week structure of the program, 3 cohorts were included during this time frame.

The intervention included both pre- and post-survey assessments, anthropometrics (height and weight), and the HPP. Over the course of 12 weeks, youth participated in afterschool programming twice a week for roughly 50 minutes (Figure 1). One day was dedicated to youth cooking and the other to nutrition education and physical activity. In addition, during the 12-week program youth and their families partook in 3 family meal nights where youth prepared a meal for themselves and their families after programming. Study design and protocol was approved by the University of Nebraska-Lincoln Institutional Review Board.

Participants and Recruitment

Two Title I elementary schools were chosen to participate in the intervention. Title I schools are defined as having ≥ 40% of the student population receiving free or reduced price school meals and have been identified as schools with high poverty levels (U.S. Department of Education, 2014). Both participating schools in this study had 65% and 82% of students receiving free and reduced priced meals (Nebraska Department of

Education, 2016). Participants included 4th and 5th grade students who were recruited through CLC. At each programming location a maximum of 15 students were recruited to participate during each cohort. Traditionally, CLC programs are designed to last only 6 weeks. Youth were informed they had joined a 12 week program, and that they were still able to leave the program after participating for 6 weeks if desired. If youth decided to leave WeCook, another student was able to take their place. Youth were allowed to participate in WeCook programming without parent/guardian consent. However, for youth to be included in the study analysis they had to give assent and have parent/guardian consent.

Intervention and Curriculum

During the fall of 2015, WeCook was piloted at one of the two programming locations. WeCook programming was designed to occur twice a week with each week having a central theme. One day (cooking day) was dedicated to youth participating in small cooking groups to make a snack to share with everyone in club. Each group had their own unique recipe that matched the weekly theme and met recipe criteria established by researchers (Table 1). During youths' time spent in their cooking groups, youth learned how to read recipes and basic cooking skills such as learning how to cut with a knife or how to use a skillet. On the second day (activity day) youth learned about nutrition and physical activity and engaged in fun activities such as tag and relays. Activities were designed to help teach youth about the lessons that were learned during club time.

At the end of the pilot, the curriculum (cooking and activity days) was evaluated and revised if needed. Final weekly themes were *WeCook Welcome*, *Motion Commotion*,

MyPlate, *Re-Think Your Drink*, *Eat a Rainbow*, *Portion Control*, *Grainy Brainy*, *Eating Out*, *Ready set Breakfast!*, *Let's Play*, *Media Mania*, and *WeCook Wrap-Up* (Table 2). Recipes used on cooking days were finalized and approved by the registered dietitians associated with the study. Activity days were finalized to the following format: introductory activity, a second activity, and wrap activity. Cooking days had the following format: introduction, activity, and wrap-up. The WeCook curriculum was developed by adapting aspects of existing curriculum including *Choose Health: Food, Fun, and Fitness; Media Smart Youth; and Up for the Challenge*.

Curriculum was delivered by WeCook staff and UNL graduate students at both sites. Undergraduate students were recruited to help staff on both cooking and activity days. Graduate and undergraduate students came from nutrition and family and consumer sciences backgrounds. Instructors and staff participated in training before each cohort. A lesson booklet containing all the materials needed for the 12-weeks was provided for each site and all staff who helped participate received weekly emails providing them that week's lesson and/or recipes.

Survey Instruments

Survey

Pre- and post-surveys were given to youth participants to collect demographic information and to assess nutrition knowledge, healthy eating behaviors and self-efficacy, and cooking attitude and self-efficacy (Appendix A). Surveys questions were chosen from the CYFAR common measures to fulfill grant requirements and from two previously validated surveys (Hall, Chai, Koszewski, & Albrecht, 2015; Lohse, Cunningham-Sabo, Walters, & Stacey, 2011). There were a total of 26 questions,

consisting of seven demographic/characteristic questions, three assessing nutrition knowledge, seven assessing healthy eating behaviors, nine assessing healthy eating self-efficacy, two assessing cooking attitude, and one assessing cooking confidence.

Healthy Plate Photo

The HPP was a pre- and post-novel assessment developed using the USDA MyPlate guidelines. The purpose of this assessment was to determine if youth were able to correctly identify healthy food options within each of the five food groups. A template was created from the USDA MyPlate for youth to place various food models on (Appendix B). Prior to any programming, youth were told to create what they thought made a healthy plate using the given food models. After youth were done making their plate, a researcher took a photograph for later analysis. This process was repeated during post-data collection at the end of the program.

Data Collection Procedure

ID Codes

Prior to the beginning of programming, researchers received participant rosters from each programming location. Youth were then designated their own unique identification number (ID). This ID was used for youth's survey and HPP.

Surveys

Pre-surveys were administered to youth on the first day of club, prior to any programming, and instructed to fill out the survey to the best of their abilities. If a youth had a question about one of the survey items a researcher clarified their question. Post-surveys were administered during the 12th week of programming under the same procedures.

Healthy Plate Photo

Youth participants were asked to complete the HPP during or after they completed their surveys because of time constraints. To complete the assessment, youth were instructed to create what they thought made a healthy plate using the given food models. Youth were also instructed that they may only use one food model per each section of the template and that it did not matter where food models were placed. After the instructions were given, youth created their healthy plate. Researchers were allowed to identify a food item's name, but not the food group that it belonged to if youth asked. After completion, a researcher took a photo. All photos were later downloaded and saved onto a secure network for analysis. All plates were identified using the same identification from the survey.

The HPP scoring system was created from the five food groups from USDA MyPlate. Each food group was given a point value of one. A sometimes or unhealthy food category was created and given a point value of zero. Prior to the start of the study, food models were placed in their appropriate categories and approved by registered dietitians working with the study (Table 3). Scores could range from zero, being the lowest, to five, being the highest. Points were awarded to food models if they were in a food group from USDA MyPlate. Food models received no points if they were from the sometimes foods category or if the food group had already been accounted for.

Anthropometrics

Youths' height and weight were measured with light clothing and no shoes using a weight scale and stadiometer by a trained researcher. Height and weight were used to calculate body mass index (BMI). Using the Centers for Disease Control and Prevention

guidelines, BMI-for-age percentiles were determined. Weight categories were defined as the following: ≥ 95th percentile for obese; between the 85th and 94.99th percentile for overweight; between the 5th and 84.99th percentile for healthy weight, <5th percentile for underweight (CDC, 2016).

Statistical Analysis

Pre and post-intervention changes in nutrition knowledge, healthy eating behavior and self-efficacy, cooking confidence and self-efficacy, and BMI were assessed using paired t-test and Chi-square test. Correlations between HPP scores and the scores of the nutrition knowledge items from the survey were conducted using Spearman correlation coefficient. All statistical analysis was conducted using IBM Statistical Package for the Social Sciences for Windows (Version 24.0). For this study, the level of significance was set at $p < 0.05$.

CHAPTER 4
Results

Demographics

A total of 85 youth participated in the WeCook program, with 69 youth included in the analysis. Youth were excluded from analysis if they did not have assent or consent, did not complete pre- and post-assessment, or participated twice in WeCook during the data collection period. The majority of participants were female (73.9 %) and mean age was 9.58 ± .70 years. Approximately 46.4% were White, 18.8% were Hispanic/Latino, 21.7% were African American, 8.7% were American Indian/Alaska Native, and 1.4% were Asian (Table 4). Overall, 54.4% of participants were overweight or obese. With respect to family socioeconomic status, 30.4% of the participants were from families whose annual incomes were less than $25,000 and 37.7% were from families with an

annual income between $25,000 and $50,000. Over half (55.6%) of youth qualified for free and reduced lunch and only 11.6% of participants had primary caretakers with a college degree or higher. Among participants, average youth BMI was 20.7 ± 4.94 pre-invention and 22.0 ± 6.32 post-intervention (P = .108).

Nutrition knowledge

Information regarding nutrition knowledge assessed using the paper survey questionnaire is located in Table 5. Overall, total scores for nutrition knowledge items increased from 3.78 ± 1.76 at pre-intervention to 5.06 ± 2.22 at post-intervention (P < 0.001). There was a statistically significant increase in knowledge on the importance of eating breakfast every day (pre-intervention score, 1.62 ± 0.96; post-intervention score, 2.50 ± 1.3; P < 0.001) and knowledge of healthy snack choices (pre-intervention score, 1.67 ± 0.96; post-intervention score, 1.98 ± .96; P<0.001).

Changes demonstrated by the HPP are represented in Table 6. The average score of making a healthy plate by identifying the necessary food groups significantly increased post-intervention (pre: 3.97 ± 0.93, post: 4.37 ± 0.82; P < 0.001). Approximately 55% of participants received the maximum score (5 points) after the intervention whereas only 31.9% received the maximum score pre-intervention. The HPP scores were positively correlated to the total scores of the self-reported nutrition knowledge items on the survey (r = 0.29, P = .007).

Food preparation/cooking attitude and self-efficacy

Results of participants' attitudes and self-efficacy towards food preparation/cooking are shown in Table 7. There were no significant changes in the amount of youth who reported that they really like to cook (84.1%) (P = .780).

Approximately 56.5% of participants reported they were able to follow a recipe by themselves after intervention while 44.9% said “yes” on this item before the intervention (P = .077).

Healthy Eating Self-efficacy

Healthy eating self-efficacy reported by youth is demonstrated in Table 8. A total of nine questions were asked to youth regarding healthy eating self-efficacy, with lower scores indicating it is harder for youth to do the stated eating behavior. Scores for three of the nine items increased (it was easier), but none were significant. Scores for six of the nine items decreased (it was harder) with four not being significant. Average scores significantly decreased after the intervention on the item related to self-efficacy in drinking 1% milk instead of 2% (pre-score, 1.61 ± .649; post-score, 1.28 ± .826; P = 0.001). In addition, the average scores decreased after the intervention for difficulty in eating fruit for an after school snack, but was not significant (pre-intervention score, 1.76 ± .476; post-intervention score, 1.57 ± .651; P = .083).

Eating behaviors

With respect to eating behaviors, the average score of the frequency of choosing a healthy snack significantly increased post-intervention (pre-score, 1.61 ± 0.839, post-score, 1.88 ± 0.832; P=.002). However, youth participants appeared more likely to consume sweet snacks such as donuts, cookies, brownies, cakes or candies after the intervention as compared to pre-intervention (pre- score, 2.46 ± 0.76; post- score, 2.18 ± 0.809 [lower score represents higher frequency of consuming sweet snacks]; P=0.027). In addition, the average score of the frequency of vegetable intake decreased post-

intervention compared to before, but was not significant (pre-intervention score, 2.55 ± .777, post-intervention score, 2.39 ± .894; P = 0.218) (Table 9).

Chapter 5
Discussion

The primary goal of this study was to determine if there were significant positive changes in nutrition knowledge, healthy eating behaviors and self-efficacy, and cooking attitude and self-efficacy after the WeCook: Fun with Food and Fitness intervention. Results demonstrated significant increases in nutrition knowledge using both paper survey and the HPP. In addition, youth demonstrated an increase in cooking attitude and self-efficacy after participating in WeCook.

Curriculum for WeCook was designed to teach youth about USDA MyPlate, fruits and vegetables, breakfast, and healthy food and drink choices. Because each week had its own unique theme, youth spent one week learning about breakfast, one week learning about USDA MyPlate and multiple weeks learning about making healthy food choices. During this time youth were able to make recipes related to the weekly theme. At post-assessment, youth demonstrated significant improvement in their knowledge about why breakfast is important, being able to identify examples of healthy snack options, and their overall nutrition knowledge. These results are consistent with a previous study that showed an experiential cooking and nutrition education program increased youth participants' nutrition knowledge (Jarpe-Ratner, Folkens, Sharma, Daro, & Edens, 2016).

Weight Status

Childhood obesity is a major public health concern and many programs are designed to help improve or maintain the weight status of youth participants. Even

though decreasing weight status was not an objective for this study, results demonstrated that youths' BMI increased from pre- to post-intervention, but was not statistically significant. However, this increase may not have been entirely preventable because of participants' age (8 – 11 years old) and that 73.9% of participants were female. Females typically start to enter puberty around the ages of 8 – 13 years old (U.S. Department of Health and Human Services [USDHHS], 2014). With the onset of puberty, individuals begin to change physiologically which causes growth and weight gain (USDHHS, 2014). The changes in weight status among participants may be partially explained by these physiological changes occurring at this time. Further cooking and nutrition programs with youth in this age group (8 – 11 years old) should consider these physiological changes when assessing weight status among participants.

Nutrition Knowledge

Traditionally, survey questionnaires have been used among various youth programs. Surveys offer researchers the opportunity to use questions that have been found to be valid and reliable among the target population. However, traditional surveys have limitations because they are not always culturally or developmentally appropriate and may not address the needs of students with learning disabilities. Previous studies that have used alternative assessment models have yielded positive results among youth. For example, Photovoice, a popular method among youth focused programs, has demonstrated that youth are able to document and explain their environments (Leung et al., 2017). However, there is a limited amount of research using alternatives to the traditional paper survey. Therefore, there is a need to create novel ideas to test knowledge of participants.

Scores for the HPP significantly increased after the WeCook intervention demonstrating the program was effective in helping youth identify healthy food options to build a healthy plate according to USDA's MyPlate. The HPP asked youth to choose from a random assortment of healthy and unhealthy food options to build a healthy plate based on USDA MyPlate. This method allowed youth to demonstrate their knowledge of MyPlate that is conceptually easier for them to understand because youth did not have to read and answer a question. It is suggested that self-reported questionnaires may be problematic when administered to youth because they may not interpret the question correctly and/or recall an accurate answer (Janz, Lutuchy, Wenthe & Levy, 2007). This issue may be even more pronounced among low income and/or minority youth because they are less likely to be proficient at reading (NCES, 2016) making it harder to read and answer traditional survey questions correctly. Thus, our results suggest that the HPP may be an alternative and useful tool for assessing nutrition knowledge about MyPlate among youth, in particular low income youth, in addition to traditional self-reported survey instruments. However, this alternative assessment needs to be further validated in future studies.

Further, it was observed that youth's total nutrition knowledge, knowledge about why breakfast is important, and identifying healthy snack options significantly increased after the WeCook intervention. As stated previously, the WeCook curriculum focused on the importance of breakfast and making healthy food choices which may explain this increase. Additionally, although not statistically significant, there was a positive trend noted for knowledge of the daily serving for total fruit and vegetables. This may be because of the relatively small sample size and because curriculum was more focused on

youth learning to make healthy food choices. Few youth cooking and nutrition programs have reported changes in nutrition knowledge. However, cooking and nutrition programs with adult participants have shown positive changes in nutrition knowledge (Reicks et al., 2016). Furthermore, results from the paper survey support the results from the HPP previously described.

Healthy eating behavior

Youth also reported positive eating behaviors. At the end of the intervention, there was a significant increase in the percentage of youth who reported they chose a healthy snack on most or every day. While there was no statistically significant change, the majority of youth reported they consumed fruit and breakfast on most or every day. These results were in agreement with previous studies that reported participants increased consumption of fruits after cooking related nutrition intervention experiences (Cunningham-Sabo & Lohs, 2013; Burrows et al., 2015).

Youth also reported some negative eating behaviors. The majority of youth reported they consumed vegetables almost never or on somedays with average scores decreasing, although not significant. A potential explanation for this is that children have a predisposition to eat foods that are sweet and salty and dislike bitter foods (Hill, 2002). This has been supported by previous studies in which parents reported that their children preferred sweet tasting foods like fruit compared to foods like vegetables (Dwyer, Needham, Simpson, & Heeney, 2007; Vanhala, Laitinen, Kaikkonen, Keinanin-Kiukaanniemi, & Korpelainen, 2010; Nepper & Chai, 2017). In addition, the WeCook curriculum did not explicitly teach participants to eat more vegetables, but encouraged youth to make healthier food choices and to limit unhealthy food choices. Future cooking

and nutrition programs may need to increase the appeal of vegetables and encourage increased vegetable intake among youth participants. Furthermore, at post-assessment, youth reported that they consumed more discretionary items such as cookies, brownies, and cakes during the prior day. While it has been reported that youth prefer sweet tasting foods (Hill, 2002), these results may not be an accurate indicator of youth eating habits because it is only reflective of one day and not a wider date range. Additional dietary assessment over longer periods of time may be needed to accurately assess youth diet behaviors after participation in a cooking related program.

Self-efficacy and attitude

Youth reported mixed results on healthy eating self-efficacy. Youth reported that it was harder for them to drink water instead of SSB, drink 1% instead of 2% milk, and eat smaller portions of high fat foods. In other youth cooking studies it has been found that after participation youth have an increased self-efficacy for fruit and vegetable preparation and consumption (Yin et al., 2012; Burrows et al., 2015). However, these studies did not indicate whether consumption of SSB or other unhealthy foods, such as high fat foods or sweet snacks changed after their cooking programs.

There are a few possible explanations on why healthy eating self-efficacy did not improve among the youth participants in this study. As previously stated, some of the participants came from low SES families. Previous work has demonstrated that youth from low SES backgrounds reported lower levels of self-efficacy for healthy eating behaviors and had a lower perception of healthy eating compared to their high SES counterparts (Ball et al., 2009). While youth demonstrated that they increased their nutrition knowledge post-intervention, the previously stated reasons may partially explain

the results from this study. For youth, particularly low SES youth, it may take longer to improve and increase self-efficacy for healthy eating because they start the program with lower self-efficacy.

Another reason for the results in this study could be that the home environments of youth participants are not supportive of healthy eating behaviors. In previous studies, low SES youth have reported greater unhealthy food available at home and less familial support for healthy eating (Ball et al., 2009). In addition, lack of nutrition and cooking knowledge among adults has been shown to lead to an increase in convenience meals and a decrease in healthy food consumption (Reicks et al, 2016). With parents being the gatekeepers to food and healthy eating at home (Lukas & Cunningham-Sabo, 2011), it may make it harder for youth to use their knowledge to increase their confidence to eat healthy if their parent or guardian lacks these skills. Therefore, future studies need to include not only youth participants, but also their parents to improve healthy eating self-efficacy.

Parents or guardians may also face challenges in providing healthy food options at home for various reasons. Employment status, access to personal or public transportation, prices of healthy food, and where families live geographically have all been shown to negatively affect lower income families access to healthy food (Caswell & Yaktine, 2013). In this study, 55.6 % of participants received free and reduced lunch and 30.4% were from families with an annual income less than $25,000, which may indicate that access to healthy food options are limited to many youth and their families. It has been shown that low income families tend to rely more on assistance, such as food pantries, to have enough food for their families to eat (Robaina & Martin, 2013). However, selection

of food items available may not be the healthiest choice which would prevent youth from increasing their healthy eating self-efficacy (Robaina & Martin, 2013). Furthermore, both schools that youth participants attended were located in food deserts (USDA, 2015), or areas that have limited access to nutritious and affordable food (Shannon, 2014). Because youth tend to live in the same geographical location as their school, youth's families may not have access to stores with healthy food items available. For these reasons youth may find it more difficult to improve their self-efficacy to eat healthy food items.

Finally, youth participants in this study may have found it difficult to answer the questions related to healthy eating self-efficacy. Youth may not have remembered what they had put for the pre-assessment or may have lacked the proper knowledge of what healthy foods were before the intervention. After learning about healthy food options through participation in WeCook, youth may have reevaluated how difficult it was to make healthier food choices. In addition, these questions may not have been appropriate for these participants because they were at a $5^{th}/6^{th}$ grade reading level (Child, Youth, and Families at Risk Common Measure, 2017). The majority of students (60.9%) reported they were in fourth grade and many of the youth were low-income and/or were minorities which may have made these questions too difficult to fully comprehend and answer correctly.

Although positive changes were not seen in self-efficacy in making healthier food choices after the WeCook intervention, a positive trend was observed showing that participants' attitude and self-confidence towards cooking improved after WeCook. This suggests that WeCook, a cooking related nutrition program, might have a more direct and

specific impact on self-efficacy related to cooking than broad impact on self-efficacy of healthy eating and making healthy food choices.

Strengths and limitations

This study had several strengths. One strength was that youth were taught through experiential or hands on learning. Experiential learning allows youth to master the knowledge by doing the activities themselves. This hands on experience is important because it enables youth to apply abstract nutrition concepts with concrete experiences with food (Nelson et al., 2013). Additionally, WeCook encouraged youth to make healthy food choices and taught youth practical life skills such as food preparation. This is important because it has been shown that adolescents that help prepare meals are significantly more likely to prepare meals as adults (Laska et al., 2011). There were also limitations to this study. First, youth may not have answered questions as truthfully or correctly understood the survey questions due to the nature of self-report survey questions. Second, based on our observation, some participants arrived late during programming or did not participate in all the sessions of the WeCook program, which could confound our results since the participants did not receive to the same dosage of the program. However, 68% of the participants participated in at least 90% of WeCook sessions. Finally, this study lacked a randomized control group, thereby reducing our ability to determine the degree of effectiveness of the intervention.

Conclusions

The results from the current study indicate that the WeCook: Fun with Food and Fitness program significantly increased nutrition knowledge related to building a healthy plate according to USDA Dietary Guidelines among youth participating in the program.

Our results also showed positive changes in youth's eating behaviors such as choosing healthy snacks and eating breakfast and also cooking attitude and cooking self-efficacy after the WeCook intervention. In addition to targeting the improvement of nutrition related knowledge and eating behaviors, future cooking related nutrition programs need to incorporate strategies to enhance youth self-efficacy in health behaviors particularly for socioeconomically disadvantaged youth.

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Table 1. WeCook Recipe Criteria

- All recipes include at least one vegetable or fruit
- Recipes have minimal added sugars – no more than 2 teaspoons of added sugar per serving
- Dairy ingredients are non-fat, low fat, or reduced fat. Milk used is skim or 1%
- Recipes have 35% or fewer calories from fat or 5 grams of fat or less per serving. When feasible, recipes have 25% or fewer calories from fat
- Recipes have been successfully tested for taste and overall appeal
- Modified recipes cite the original source whenever possible
- Recipes are culturally appropriate for the intended audience
- Recipes are affordable and readily available ingredients are used
- Availability of supplies and equipment needed for recipes are taken into consideration
- Time, reading level, and skill level to prepare the recipe are taken into consideration
- Short sentences and simple words are used to descried the steps of the recipe

Table 2. Finalized Weekly WeCook Themes for Cooking and Activity Days

Week	Theme	Recipes
1	WeCook Welcome	Strawberry Mice Apple Monsters
2	Motion Commotion	Pita Crisps No-Bake Energy Bites Fruit Pinwheels
3	MyPlate	Black Bean and Corn Quesadilla Berry Best Bagels Taco Salad
4	Re-Think Your Drink	Lemon Lime Smoothie Blueberry Chai Green Smoothie Tuttie-Frutti Smoothie
5	Eat a Rainbow	Tropical Fruit Dip Healthy Pumpkin Pie Dip Pocket Fruit Pies
6	Portion Control	Fruit Salsa Cinnamon Sugar and Lightly Slated Tortilla Chips Colorful Corn Salsa
7	Grainy Brainy	Whole-Wheat Cranberry Orange Muffins Whole-Wheat Blueberry Pancakes Sandwich Shapes
8	Eating Out	Broccoli Mac & Cheese Italian BMT Sandwich Baked Avocado Fries
9	Ready set Breakfast	Morning Sunflower Breakfast Pizza Tropical Breakfast Parfait
10	Let's Play	Cucumber Yogurt Dip Pan Fried Cinnamon Bananas Mini Blueberry Muffins
11	Media Mania	Oatmeal Craisin® White Chocolate Chip Cookies McCormick® Creamy Cinnamon Dip Fruity Rice Krispies® Bar
12	WeCook Wrap-Up	Ice Cream Social

Table 3. Healthy Plate Photo Food Models

	Fruit (1 point)	Vegetables (1 point)	Grains (1 point)	Protein (1 point)	Dairy (1 point)	Unhealthy/Sometimes (0 points)
Food Models	Orange	Baked potatoes	Baguette	Salmon	Milk carton	Donut
	Banana	Peas	oatmeal	Steak	Yogurt	Waffles
	Red apple	Tomato	Wheat Bread	Chicken brest	Cheese slice	Chocolate bar
	Strawberries	Eggplant	Pasta	Hardboiled egg	Milk glss	Chocolate chip cookie
	Pineapple slices	Sugar Snap Peas	Dinner Roll	over-easy egg	Swiss cheese Slice	French Fries
	100% grape juice	Broccoli		Lunch meat		Pancake
	100% orange juice	Green Pepper		Beans		Ice Cream sandwich
	grapefruit half	Salad		Peanut butter		Chocolate milk
	Green apple	Corn				Cinnamon roll
	Apple slices	Carrot				Ice cream cone
	Berries	Asparagus				Pretzels
	Berries	Zucchini				
	Cantaloupe	Sweet Potato				
		Lettuce				

Table 4. Characteristics of Youth Study Participants (N=69)

Characteristics	**All Participants**	
Gender, N (%)		
Male	18 (26.1)	
Female	51 (73.9)	
Race/ethnicity, N (%)		
American Indian or Alaska Native	6 (8.7)	
Asian	1 (1.4)	
Black or African American	15 (21.7)	
Hispanic/Latino	13 (18.8)	
Native Hawaiian or Other Pacifica	1 (1.4)	
Islander	32 (46.4)	
White		
Weight Characteristics[a]	**Pre-WeCook**	**Post-WeCook**
Body Weight (Kg), mean (SD)	41.7 (12.5)	46.2 (15.7)
Body mass index (kg/m^2), mean (SD)	20.7 (4.94)	22.0 (6.32)
Weight Status		
Under weight, n (%)	2 (3.03)	0 (0.00)
Healthy weight, n (%)	33 (50.0)	31 (45.6)
Overweight (), n (%)	8 (12.1)	10 (14.7)
Obese, n (%)	23 (34.8)	27 (39.7)

[a] Underweight: BMI-for age percentile, < 5^{th}; Healthy weight: BMI for age percentile 5^{th} -85^{th}; Overweight: BMI for age percentile 85^{th} - 95^{th}; Obese: BMI for age percentile > 95^{th}.

Table 5. Nutrition Knowledge Results among Youth Study Participants Pre and Post WeCook Intervention (N = 69)[a]

	Pre-WeCook n (%)	**Post-WeCook** n (%)	**P-value[b]**	**Chi-square P-value[c]**
Amount of daily fruit and vegetable consumption[d]				.112
Answer correctly	34 (50.0)	27 (40.3)		
Answer incorrectly	34 (50.0)	40 (59.7)		
Average Score, mean±SD[e]	.203 ± .505	.515 ± .450	.242	
Choice of healthy snacks[f]				<.0001
0 of 3 correct answers	2 (2.9)	1 (1.4)		
1 of 3 correct answers	37 (53.6)	28 (40.6)		
2 of 3 correct answers	12 (17.4)	12 (17.4)		
3 of 3 correct answers	18 (26.1)	27 (39.1)		
Average Score, mean±SD[e]	1.67 ± .962	1.98 ± .962	.024	
Importance of eating breakfast[g]				<.0001
0 of 3 correct answers	0 (0.0)	1 (1.4)		
1 of 3 correct answers	44 (63.8)	26 (37.7)		
2 of 3 correct answers	12 (17.4)	3 (4.3)		
3 of 3 correct answers	8 (11.6)	17 (24.6)		
4 of 4 correct answers	5 (7.2)	22 (31.9)		
Average Score, mean±SD	1.62 ± .956	2.49 ± 1.39	<.0001	
Total Nutrition Knowledge[h], mean±SD	3.78 ± 1.76	5.08 ± 2.22	<.0001	.002

[a] Higher scores indicated a more positive response.

[b] P-value was calculated using Paired t-test between pre and post intervention means for average scores for each knowledge survey item or total scores of all the knowledge survey items.

[c] P-value of chi-square test for pre- and post-intervention differences in frequency of the responses to each of survey question item.

[d] If a participant answered correctly, "1" was assigned as a score; if a participant answered incorrectly, "0" was assigned as a score. The maximum score is "1".

[e] Average score = total score of all the participants' responses to the survey item /n of participants (Pre or post intervention); A higher score indicates a more positive response.

[f] If a participant had no correct answers, "0" was assigned as a score; if a participant had 1 correct answer, "1" was assigned as a score; if a participant had 2 correct answers, "2" was assigned as a score; if a participant had 3 correct answers, "3" was assigned as a score. The maximum score is "3".

[g] If a participant had no correct answers; "0" was assigned as a score; if a participant had 1 correct answer, "1" was assigned as a score; if a participant had 2 correct answers, "2" was assigned as a score; if a participant had 3 correct answers, "3" was assigned as a score; if a participant had 4 correct answers, "4" was assigned as a score. The maximum score is "4".

[h] Total score is the sum of all the knowledge items on the survey; A higher score indicates a more positive response

Table 6. Healthy Plate Photo Results among Youth Student Participants Pre and Post WeCook Intervention (N=69)[a]

	Pre n (%)	**Post** n (%)	**P-value[b]**	**Chi-square P-value[c]**
Healthy Plate Score[d]				<0.0001
0 out of 5	0 (0.0)	0 (0.0)		
1 out of 5	0 (0.0)	0 (0.0)		
2 out of 5	5 (67.6)	3 (4.3)		
3 out of 5	14 (21.2)	6 (8.7)		
4 out of 5	25 (37.9)	22 (31.9)		
5 out of 5	22 (33.3)	38 (55.1)		
Average Score[e], mean±SD	3.97 ±.928	2.49 ± 1.39	<.0001	

[a] Higher scores indicated a more positive

[b] P-value was calculated using Paired t-test between pre and post intervention means for average scores for Healthy Plate Photo test

[c] P-value of chi-square test for pre- and post-intervention differences in frequency of the responses

[d] If a participant had no correct answers; "0" was assigned as a score; if a participant had 1 correct answer, "1" was assigned as a score; if a participant had 2 correct answers, "2" was assigned as a score; if a participant had 3 correct answers, "3" was assigned as a score; if a participant had 4 correct answers, "4" was assigned as a score; if a participant had all the correct answers, "5" was assigned as a score. The maximum score is "5".

[e] Average score = total score of all the participants' responses for the survey item / n of participants (Pre or post intervention); A higher score indicates a more positive response

Table 7. Cooking Attitude and Self-efficacy Results among Youth Study Participants Pre and Post WeCook Intervention (N = 69)[a]

	Pre n (%)	**Post** n (%)	**P-value[b]**	**Chi-square P-value[c]**
Likeness for cooking[d]				<0.0001
I really don't like to cook	1 (1.4)	1 (1.4)		
I don't like to cook	0 (0.0)	0 (0.0)		
I'm not sure if I like to cook	3 (4.3)	1 (1.4)		
I kind of like to cook	7 (10.1)	9 (13.0)		
I really like to cook	58 (84.1)	58 (84.1)		
Average score[e], mean±SD	4.75 ± .673	4.78 ± .615	.780	
Likeness for making food with family[d]				<0.0001
I really don't like to make food with my family	1 (1.4)	1 (1.4)		
I don't like to make food with my family	1 (1.4)	4 (5.8)		
I'm not sure if I like to make food with my family	2 (2.9)	1 (1.4)		
I kind of like to make food with my family	12 (17.0)	15 (21.7)		
I really like to make food with my family	53 (76.8)	48 (69.6)		
Average score[e], mean±SD	4.66 ± .673	4.52 ± .901	.221	
Confidence for following a recipe[f]				<0.0001
I have never followed a recipe, and I don't feel I could	3 (4.3)	1 (1.4)		
I can follow a recipe with help from someone	35 (50.0)	29 (42.0)		
I can follow a recipe by myself	31 (44.9)	39 (56.5)		
Average Score[e], mean±SD	2.41 ± .577	2.55 ± .529	.077	.
Total Cooking Score[g]	11.8 ± 1.17	11.8 ± 1.54	.879	

[a] For all questions, a higher score indicates a more positive response.

[b] P-value was calculated using Paired t-test between pre and post intervention means for average scores for each cooking attitude or self-efficacy survey item or total scores of all the three cooking related survey items.

[c] P-value of chi-square test for pre- and post-intervention differences in frequency of the responses to each cooking attitude or self-efficacy survey question item.

[d] The responses to the items were scored from 1 to 5 with a higher score reflecting a more positive response.

[e] Average score = total score of all the participants' responses for the survey item / n of participants (Pre or post intervention); A higher score indicates a more positive response.

[f] The responses to the items were scored from 1 to 3 with a higher score reflecting a more positive response.

[g] Total cooking score is the sum of the scores of the three cooking related survey items; A higher score indicates a more positive response.

Table 8. Eating Self-Efficacy Results among Youth Study Participants Pre and Post WeCook Intervention (N = 69)[a]

	Pre n (%)	**Post** n (%)	**P-value[b]**	**Chi-square P-value[c]**
Difficulty in eating fruit for after-school snack[d]				
Not Hard	51 (73.9)	45 (65.2)		
A little Hard	16 (23.2)	19 (27.5)		
Very Hard	2 (2.9)	5 (7.2)		
Average Score[e]	1.71 ± .517	1.58 ± .628	.083	<.0001
Difficulty in eating vegetables for after-school snack[d]				
Not Hard	28 (40.6)	34 (49.3)		
A little Hard	28 (40.6)	21 (30.4)		
Very Hard	13 (18.8)	14 (20.3)		
Average Score[e]	1.22 ± .745	1.29 ± .788	.496	.011
Difficulty in choosing water over SSB when thirsty[d]				
Not Hard	40 (58.8)	34 (50.0)		
A little Hard	22 (32.4)	26 (38.2)		
Very Hard	6 (8.8)	8 (11.8)		
Average Score	1.50 ± .658	1.38 ± .692	.270	<.0001
Difficulty in drink 1% milk instead of 2% milk[d]				
Not Hard	48 (71.6)	34 (49.3)		
A little Hard	12 (17.9)	17 (24.6)		
Very Hard	7 (10.4)	18 (26.1)		
Average Score[e]	1.64 ± .644	1.26 ± .834	.001	.019
Difficulty in choosing a small instead of large order of French fries[d]				
Not Hard	40 (58.8)	44 (63.8)		
A little Hard	17 (25.0)	16 (23.2)		
Very Hard	11 (16.2)	13 (13.0)		
Average Score[e]	1.42 ± .759	1.51 ± .720	.533	<.0001
Difficulty in eating smaller serving of high fat foods[d]				
Not Hard	30 (44.1)	23 (33.3)		
A little Hard	24 (35.3)	29 (42.0)		
Very Hard	14 (20.6)	17 (24.6)		
Average Score[e]	1.23 ± .775	1.12 ± .778	.221	.209
Difficulty in eating low-fat snacks instead of high fat snacks[d]				
Not Hard	48 (70.6)	42 (60.9)		
A little Hard	14 (20.6)	18 (26.1)		
Very Hard	6 (8.8)	9 (13.0)		
Average Score[e]	1.62 ± .647	1.48 ± .720	.124	<.0001
Difficulty to drink less soda pop[d]				
Not Hard	39 (56.5)	39 (57.4)		
A little Hard	21 (30.4)	18 (26.5)		
Very Hard	9 (13.0)	11 (16.2)		
Average Score[e]	1.44 ± .717	1.40 ± .758	.892	<.0001
Difficulty to drink less Kool-Aid[d]				
Not Hard	44 (66.7)	47 (68.1)		
A little Hard	16 (24.2)	18 (26.1)		
Very Hard	6 (9.1)	4 (5.8)		
Average Score[e]	1.58 ± .657	1.62 ± .597	.594	<.0001

[a] For all questions, a higher score indicates a more positive response.

[b.] P-value was calculated using Paired t-test between pre and post intervention means for average scores for each eating self-efficacy survey item.

[c]. P-value of chi-square test for pre- and post-intervention differences in frequency of the responses to each eating self-efficacy survey question item.

[d] The responses to the items were scored from 0 to 2 with a higher score reflecting a more positive response.

[e] Average score = total score of all the participants' responses for the survey item / n of participants (Pre or post intervention); A higher score indicates a more positive response.

Table 9. Eating Behavior Results among Study Participants Pre and Post We-Cook Intervention (N=69)

	Pre n (%)	**Post** n (%)	**P-value[a]**	**Chi-square P-value[b]**
How many times youth ate French fries or chips yesterday[c]				
5 or more times	3 (4.3)	4 (5.8)		
3-4 times	3 (4.3)	7 (10.1)		
1-2 times	16 (23.2)	16 (23.2)		
0 times	47 (68.1)	42 (60.9)		
Average score[d]	2.55 ± .777	2.39 ± .894	.218	<.0001
How many times youth ate donuts, cookies, brownies, cakes or candy, yesterday[c]				
5 or more times	3 (4.3)	5 (7.2)		
3-4 times	2 (2.9)	2 (2.9)		
1-2 times	24 (34.8)	37(53.6)		
0 times	40 (58.0)	25 (36.2)		
Average Score[d]	2.46 ± .760	2.18 ± .809	.027	<.0001
How many times youth drank any regular sodas or soft drinks, punch, sports drinks, or other fruit-flavored drinks, yesterday[c]				
5 or more times	4 (5.8)	4 (5.8)		
3-4 times	7 (10.1)	6 (8.7)		
1-2 times	27 (39.1)	27 (39.1)		
0 times	31 (44.9)	32 (46.4)		
Average Score[d]	2.24 ± .881	2.26 ± .852	.894	<.0001
How often youth ate vegetables[e]				
Never or almost never	6 (9.1)	8 (11.6)		
Some days	28 (42.4)	30 (43.5)		
Most Days	21 (30.4)	21 (30.4)		
Every day	11 (16.7)	10 (14.5)		
Average Score	1.56 ± .879	1.48 ± .885	.541	<.0001
How often youth ate fruit[e]				
Never or almost never	2 (3.0)	0 (0.0)		
Some days	14 (20.3)	13 (18.8)		
Most Days	22 (33.3)	30(43.5)		
Every day	28(40.6)	26(37.7)		
Average Score[d]	2.15 ± .864	2.18 ± .733	.551	.032
How often youth chose a healthy snack[e]				
Never or almost never	5 (7.6)	3 (4.3)		
Some days	26 (39.4)	19 (27.5)		
Most Days	25 (37.9)	30 (43.5)		
Every day	10 (15.2)	17 (24.6)		
Average Score[d]	1.61 ± .839	1.88 ± .832	**.002**	<.0001
How often youth ate breakfaste				
Never or almost never	0 (0.0)	1 (1.4)		
Some days	8 (11.6)	7 (10.1)		
Most Days	10 (14.5)	10 (14.5)		
Every day	48 (69.5)	51 (73.9)		
Average Score[d]	2.62 ± .718	2.62 ± .749	.581	<.0001

[a] P-value was calculated using Paired t-test between pre and post intervention means for average scores for each eating behavior survey item.

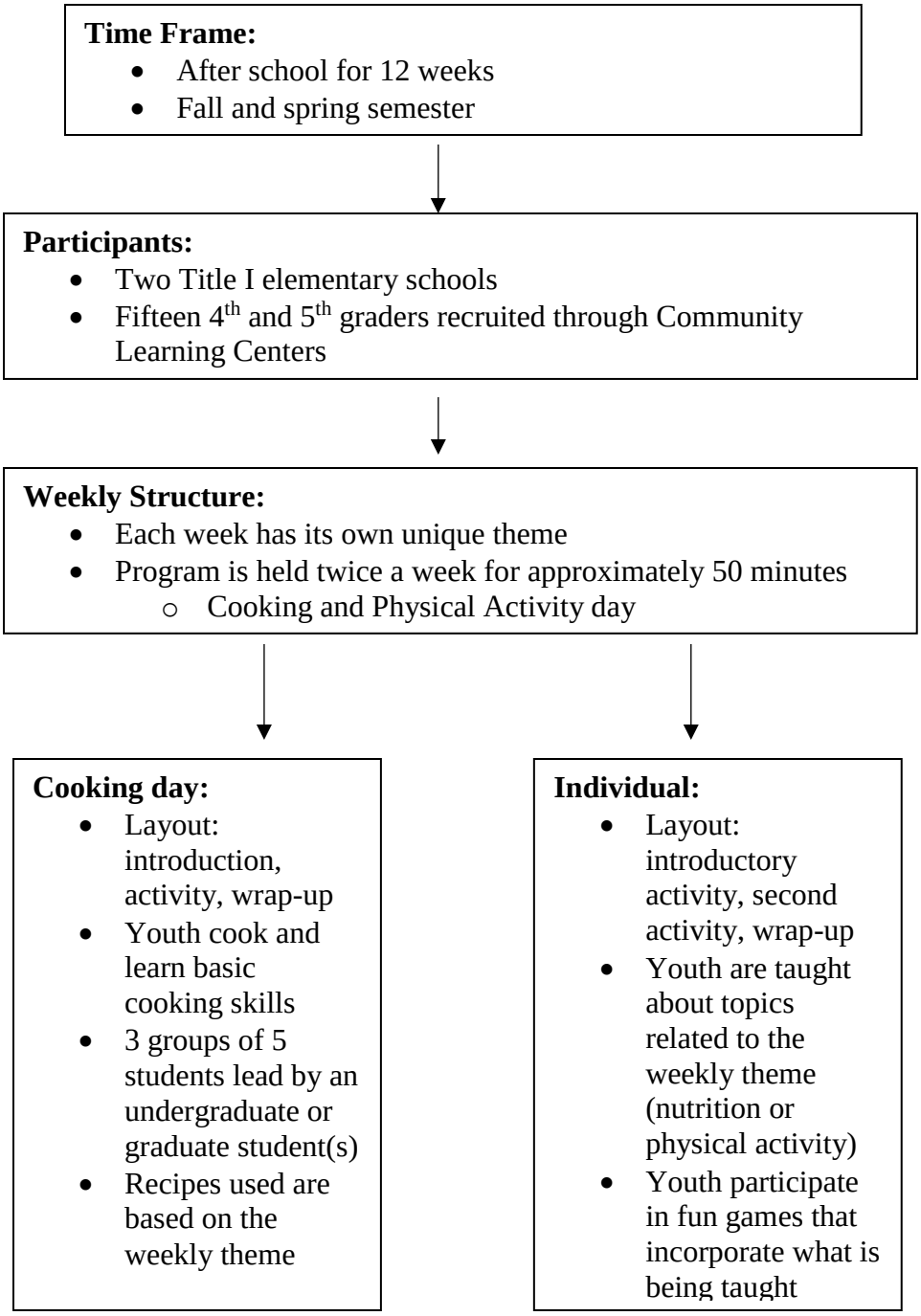
[b]. P-value was calculated using chi-square test for pre- and post-intervention differences in frequency of the responses to each eating self-efficacy survey question item.

[c] The responses to the items were scored from 0 to 3 with a higher score reflecting a more positive response.

[d] Average score = total score of all the participants' responses for the survey item / n of participants (Pre or post intervention); Higher score indicates a more positive response; A higher score indicates a more positive response.

[e].The responses to the items were scored from 1 to 3 with a higher score reflecting a more positive response.

Figure 1. WeCook Study Design for both Title I Elementary Schools



Appendix A
Youth Survey

Participant ID # _____ Date _____

Please DO NOT write your name on this survey.

The answers you give will be kept private. This survey is voluntary.

DIRECTIONS: Please select the appropriate response for each item below.

1. I am a:
   _____ Male _____ Female

2. How old are you? _____

3. What grade are you in school? _____

4. What is your ethnicity? (Select one)
   _____ Hispanic or Latino _____ Not Hispanic or Latino

5. What is your race? (Select one or more)
   _____ Asian _____ American Indian or Alaska Native
   _____ Black or African American _____ Native Hawaiian or Other Pacific Islander
   _____ White

6. Is your parent(s) involved in the military including the Guard or Reserve?
   _____ Yes _____ No

7. If yes, please specify
   _____ Air Force _____ Army _____ Guard
   _____ Marine Corps _____ Navy _____ Reserve

8. How many sessions of this club or activity have you participated in?
   _____

9. About how many hours per week do you participate in this club or activity?
   _____ Less than 1 hour _____ 6-7 hours
   _____ 1 hour _____ 8-9 hours
   _____ 2-3 hours _____ 10 or more hours
   _____ 4-5 hours

10. How long have you participated in 4-H?
    _____ Less than 1 year _____ 6-7 years
    _____ 1 year _____ 8-9 years
    _____ 2-3 years _____ 10 or more years
    _____ 4-5 years _____ Does not apply to me

11. How long have you participated in any in-school activities like sports, student government, drama or dance, academic clubs, pep clubs, band or symphony?

_____ Less than 1 year	_____ 6-7 years
_____ 1 year	_____ 8-9 years
_____ 2-3 years	_____ 10 or more years
_____ 4-5 years	_____ Does not apply to me

12. How long have you participated in any other out-of-school activities like Boy Scouts, Girl Scouts, YMCA, Girls Inc., Junior Achievement, or youth groups at church, synagogue, or mosques?

_____ Less than 1 year	_____ 6-7 years
_____ 1 year	_____ 8-9 years
_____ 2-3 years	_____ 10 or more years
_____ 4-5 years	_____ Does not apply to me

DIRECTIONS: The following questions ask about your eating habits and how hard you think it would be for you to eat more of some foods and eat less of other foods. **How hard would it be for you to…**

#	Item	0 Not hard at all	1 A little hard	2 Very hard
1.	Eat fruit for an after school snack?			
2.	Eat vegetables for an after school snack?			
3.	Choose water instead of soda pop or Kool-Aid when you are thirsty?			
4.	Drink 1% or skim milk instead of 2% or whole milk?			
5.	Choose a small instead of a large order of French fries?			
6.	Eat smaller servings of high fat foods like French fries, chips, snack cakes, cookies, or ice cream?			
7.	Eat a low-fat snack like pretzels instead of chips?			

8.	Drink less soda pop?			
9.	Drink less Kool-Aid?			

DIRECTIONS: The following questions ask you about being active. Being active can mean playing a sport, playing outside with friends, or doing an activity like riding a bike. Choose the answer which best shows how you feel about physical activity.

#	Item	0 Not at all like me	1	2 A lot like me
1.	I can ask my friends to be active with me.			
2.	I can ask my parents or another adult to do active things with me.			
3.	I have the skills I need to be active.			
4.	I can be active most days after school.			
5.	I can be active no matter how busy my day is.			
6.	I can be active no matter how tired I may feel.			
7.	I can be active even if it is hot or cold outside.			
8.	I can be active even if I have a lot of homework.			
9.	I can be active after school even if I could watch TV or play video games instead.			
10.	I can be active even if I have to stay at home.			
11.	I can be active even when I'd rather be doing something else.			

DIRECTIONS: The next 2 questions ask about physical activity. Place an "x" in the ONE box that represents your answer.

1. How often are you physically active for at least 60 minutes per day or more? (This includes activities such as exercise, sports, running, walking, dancing, etc.)
   - ☐ 7 days per week
   - ☐ 5-6 days per week
   - ☐ 3-4 days per week
   - ☐ 1-2 days per week
   - ☐ 0 days per week

2. Why is physical activity good for kids?
   - ☐ Helps keep you from getting sick
   - ☐ Helps you pay attention in school
   - ☐ Builds healthy bones and muscles to keep you strong
   - ☐ Gives you energy
   - ☐ All of the above

DIRECTIONS: Circle the answer that best applies to you.

#		1	2	3	4
1.	I eat vegetables…	Never or almost never	Some days	Most days	Every day
2.	I eat fruit…	Never or almost never	Some days	Most days	Every day
3.	I choose healthy snacks…	Never or almost never	Some days	Most days	Every day
4.	I eat breakfast…	Never or almost never	Some days	Most days	Every day

DIRECTIONS: Place an "x" in the ONE box that represents your answer.

1. Yesterday, how many times did you eat French fries or chips? Chips are potato chips, tortilla chips, corn chips, or other snack chips.
   - ☐ None
   - ☐ 1-2 times
   - ☐ 3-4 times
   - ☐ 5 or more times

2. Yesterday, how many times did you eat doughnuts, cookies, brownies, cakes or candy?
   - ☐ None
   - ☐ 1-2 times
   - ☐ 3-4 times
   - ☐ 5 or more times

3. Yesterday, how many times did you drink any regular sodas or soft drinks, punch, sports drinks, or other fruit-flavored drinks? (Do not count 100% juice or diet drinks)
   - ☐ None
   - ☐ 1-2 times
   - ☐ 3-4 times
   - ☐ 5 or more times

4. How many total cups of fruit and vegetables combined should you eat each day?
   - ☐ Less than 2 cups
   - ☐ At least 2 cups
   - ☐ At least 3 cups
   - ☐ At least 4 cups

5. How do you feel about cooking?
   - ☐ I **really like** to cook.
   - ☐ I **kind of like** to cook.
   - ☐ I **don't like** to cook.
   - ☐ I **really don't like** to cook.
   - ☐ I'm **not sure if I like** to cook.

6. How do you feel about making foods with your family?
   - ☐ I **really like** to make food with my family.
   - ☐ I **kind of like** to make food with my family.
   - ☐ I **don't like** to make food with my family.
   - ☐ I **really don't like** to make food with my family.
   - ☐ I'm **not sure if I like** to make food with my family.

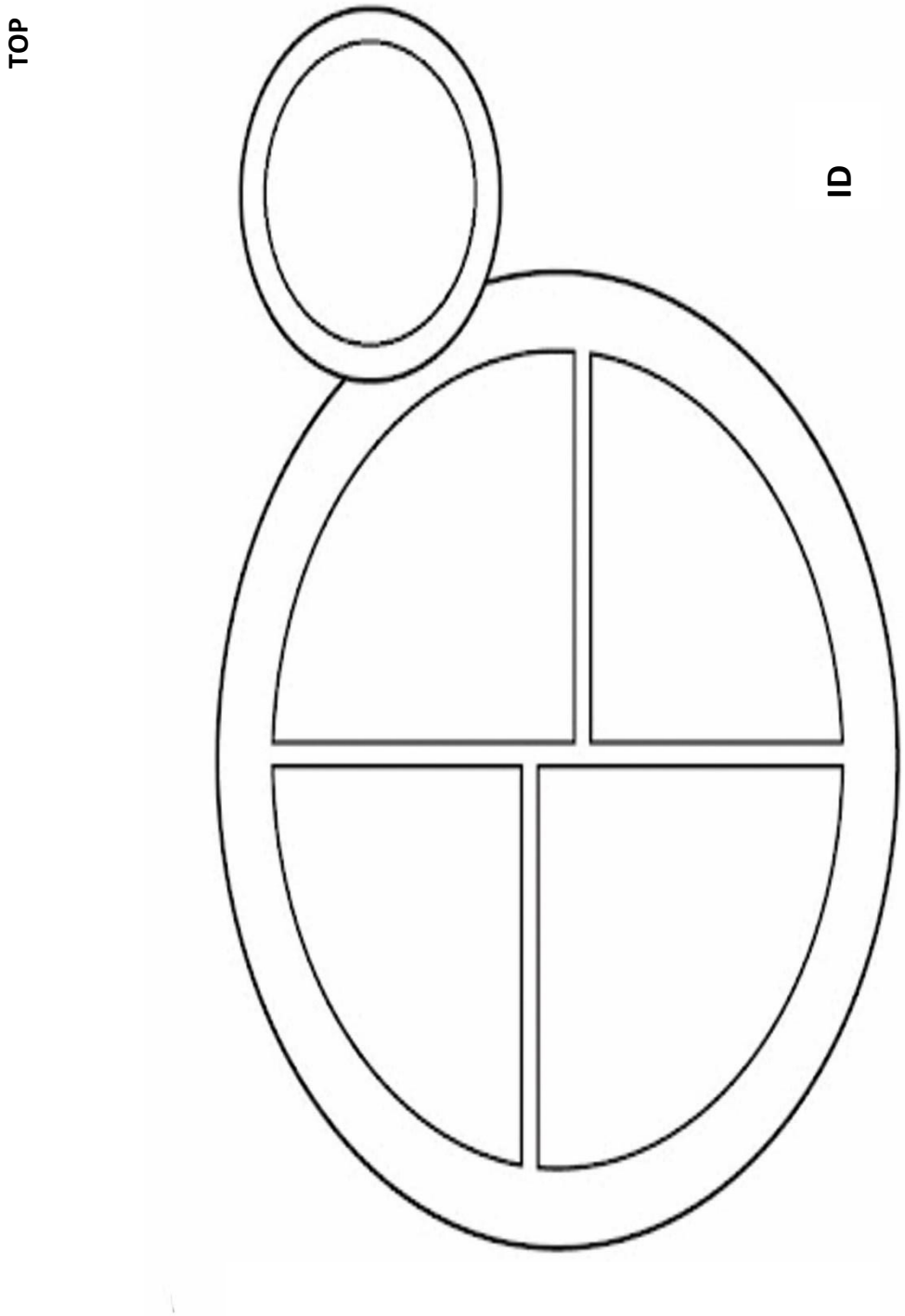
7. Which of the following statements best describes you?
   - ☐ I can follow a recipe by myself.
   - ☐ I can follow a recipe with help from someone else.
   - ☐ I have never followed a recipe, and I do not feel I could make it by myself.

DIRECTIONS: Place an "x" in ALL boxes that represent ALL answers you think are correct.

1. Which of the following would be a healthy choice for a snack? Check ALL that apply.
   - ☐ Fruit and yogurt
   - ☐ Sports drink and cheese puffs
   - ☐ Whole grain crackers and cheese
   - ☐ Celery and peanut butter
   - ☐ Fruit juice and potato chips

2. Why is breakfast important? Check ALL that apply.
   - ☐ Helps you learn
   - ☐ Gives you energy
   - ☐ Makes you weaker
   - ☐ Helps keep you from getting sick
   - ☐ Helps you think and concentrate

Appendix B
Healthy Plate Photo Template



Appendix C
Youth Assent Form

University of Nebraska Lincoln

COLLEGE OF EDUCATION & HUMAN SCIENCES
Department of Nutrition & Health Sciences

Youth Assent Form (IRB#15356)
Nebraska Children, Youth, and Families At-Risk Sustainable Community Project—**WeCook**

You are invited to participate in this research project because you are between 8 and 12 years old. You will participate in a 60-minute, after-school *WeCook: Fun with Food and Fitness* club twice a week for 12 weeks. One day each week you will learn how to prepare healthy snacks and meals. The other day each week you will participate in fun physical activities. You and your family will participate in family meal nights once a month throughout the 12 weeks (3 family meal nights total; 60 minutes in length). On club days with family meal nights, you will help prepare a meal during club for you and your family to enjoy together that day.

You will wear a Fitbit wristband for one week at the beginning and end of the program (two times total). If the Fitbit is lost or broken, you will NOT need to replace it. However, you will not be given a new Fitbit to wear during the program. You will return the Fitbit at the end of each one-week period of time you are allowed to wear it.

You will answer survey questions about what you eat, how you eat (eating behaviors), how you feel about cooking, and how active you are (physical activity). You will also answer questions about who you are (for example, if you are a girl or a boy, your ethnicity, age, and which grade you are in at school). We will measure your height and weight. We will also take photos of healthy plates you create using fake food (food models) at the beginning and end of club. You will NOT appear in these photos.

Your responses will be kept totally secret (confidential), and there is no way for us to know which responses belong to you or someone else. We may publish a summary of everyone's responses and present it at scientific meetings, but your identity and responses will be totally secret (confidential).

We will also ask your parents for their permission for you to participate. If you have any questions or concerns during the club, please ask the researchers.

_____ _____
Signature of Research Participant Date

Name and phone number of investigators:

Weiwen Chai, PhD, Assistant Professor, UNL Office: 402-472-7822

Tara Dunker, MS, RD, WeCook Project Coordinator, UNL Office: 402-472-4741

Appendix D
Adult Consent Form

University of Nebraska Lincoln

COLLEGE OF EDUCATION & HUMAN SCIENCES
Department of Nutrition & Health Sciences

Participant/Parent-Legal Guardian Informed Consent Form (IRB#15356)

Nebraska Children, Youth, and Families At-Risk Sustainable Community Project—**WeCook**

Purpose:
This research project will assess the impact of an after-school program focusing on food preparation skills, nutrition and physical activity. You and your child/legal ward are invited to participate in this research project because your child/legal ward is between 8 and 12 years old.

Procedures:
Your child/legal ward will participate in a semi-weekly (twice a week), 60-minute, after-school club, *WeCook: Fun with Food and Fitness* for 12 weeks. They will learn about food preparation, nutrition, and physical activity. Families are invited to participate in family meal nights throughout the 12 weeks (3 family meal nights total; 60 minutes in length). Your child/legal ward will prepare a nutritious family meal during the club period. Your family will then be able to enjoy this meal together at the school.

Your child/legal ward will wear a Fitbit wristband for one week at the beginning and end of the club (two times total). The Fitbit wristband will be synced to an internet-connected computer so that each child can view his/her individual activity data. However, your child/legal ward will not be required to sign up for an account. In the event that the Fitbit is lost or broken, you and your child/legal ward will NOT be held responsible for replacing it. However, your child/legal ward will not be given a new Fitbit to wear during the program. Your child/legal ward is expected to return the Fitbit at the end of each one-week period of time they are allowed to wear it.

Your child/legal ward will be asked to complete surveys regarding demographic information, food preparation skills, eating behaviors, and physical activity at the beginning and end of the program. Weight and height will be measured with your child/legal ward wearing light clothing and no shoes at the beginning and end of the program. Photos will be taken of healthy plates your child/legal ward creates at the beginning and end of the program. However, your child/legal ward will NOT appear in these photos. You will also be asked to complete surveys regarding demographic information, food preparation skills, eating behaviors, and physical activity at the beginning and end of the program. Completion of the surveys will take approximately 20 minutes. In addition, a 30-minute six-month follow-up session may be provided for both you and your child/legal ward.

Benefits:
Your child will gain knowledge and experience in food preparation, nutrition and physical activity. You and your family will enjoy meal times together. Participation in this research project will assist in creating and/or maintaining healthy habits.

Risks and/or Discomforts:
There are no known risks or discomforts associated with this research project.

Confidentiality:
Any information obtained during this research project, which could identify your child/legal ward, will be kept strictly confidential. Any names, addresses, or phone numbers will be deleted after the research project is completed. The data will be stored in a locked cabinet and will only be seen by the research team during the research project and for up to five years after completion. Data related to Fitbit activity will be stored in a highly secure research database, and only the research team will have access. This data will not link to your child/legal ward's identifiable information. The information obtained may be published in scientific journals or presented at scientific meetings, but the data will be reported as aggregated data with no identifying information released.

Opportunity to Ask Questions:
You and your child/legal ward may ask any questions concerning this research and have those questions answered before agreeing to participate or during the program. You may also contact the investigators at the phone numbers or e-mail addresses below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or to ask any questions about your rights as a research participant.

Freedom to Withdraw:
Participation is voluntary. Your child/legal ward can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln. Withdrawal will not result in any penalty or loss of benefits to which you are otherwise entitled.

Consent, Right to Receive a Copy:
You are voluntarily deciding whether or not to participate in this research project, as well as making a decision whether or not to allow your child/legal ward to participate. Your signature certifies that you allow yourself and your child/legal ward to participate, having read and understood the information presented. You may request a copy of this consent form to keep.

Name & Signature of Parent/Legal Guardian:

_____
(Name of Parent/Legal Guardian: Please Print)

_____ _____
(Signature of Parent/Legal Guardian) Date

Name and phone number of investigator:

Weiwen Chai, PhD, Assistant Professor, UNL Office: 402-472-7822

Tara Dunker, MS, RD, WeCook Project Coordinator, UNL Office: 402-472-4741