CONNECTING KINDERGARTEN READINESS AND FOOD-BASED LEARNING IN THE HEAD START PRESCHOOL CLASSROOM

by

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## ABSTRACT

While food-based learning (FBL) has been cited as the most effective way to increase children's preference and consumption of vegetables in the preschool classroom, teachers face barriers such as limited time or competing priorities. Integration of FBL with other learning domains is one promising solution; however, research is needed to understand teachers' use and perception of integrative FBL experiences. The purpose of this phenomenological qualitative study was to explore common experiences of Head Start (HS) teachers' use and integration of FBL with science learning in the HS classroom. Thirty-five in-depth semi-structured telephone interviews were conducted with HS teachers from 16 counties across the three regions of North Carolina. Participants were 94% female, 40.8 years (SD 10.06), and predominantly white (52.9%) or Black/African American (44.1%) and of non-Hispanic (97.1%) ethnicity. All interviews were audio recorded and transcribed verbatim. Researchers identified significant statements through open coding which were grouped into themes. Researchers identified 11 primary themes which were inductively organized into the Systems Thinking Iceberg Model. Teachers described most frequently utilizing FBL during mealtimes. Teachers stated they felt successful when children were engaged and willing to try a new food. However, teachers struggled to connect food to academic concepts (e.g., science, mathematics, literacy). Teachers reported several motivators (e.g., improving health) and barriers (e.g., food waste) to integrating FBL. A few teachers saw a connection between FBL and kindergarten readiness but the majority of teachers = did not. Implications for teacher professional development and resources to improve FBL integration in ways that promote kindergarten readiness are discussed.

# CONNECTING KINDERGARTEN READINESS AND FOOD-BASED LEARNING IN THE HEAD START PRESCHOOL CLASSROOM

A Thesis

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By

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## CHAPTER 1: INTRODUCTION

Childhood obesity is a widely recognized national problem (Birch, 2009) with local impacts. In the United States (US), approximately 30% of preschool-aged (3-5 years) children are considered overweight or obese (Ogden et al., 2014). Similar statistics have been observed locally, with counties in Eastern North Carolina (NC) often experiencing higher rates than the rest of the State (North Carolina Pediatric Nutrition and Epidemiology Surveillance System, 2019). Rates of overweight and obesity in young children are alarming because the habits established during the preschool years (3-5 years old) are suggested to impact long-term health status (De Cosmi et al., 2017; Ventura & Worobey 2013; Harris, 2008; Birch, 1999). Preschool children in the US spend the vast majority of their day and consume half or more of their daily dietary intake in preschool (Frisvold & Lumeng, 2011). Thus, for many children the first influence on their health occurs outside of the home in childcare (Swindle et al., 2017). During the preschool years, children are continually learning from their environment and the people they are with (Birch, 1999), placing early childhood teachers in a critical position to promote positive dietary behaviors for children (Davison & Birch, 2001; Ritchie et al., 2005; Wolfenden et al., 2001). Positive health experiences that preschool children have with early childhood teachers can have drastic health implications such as placing them at lower risk for later diseases including obesity, hypertension, type II diabetes, cancer, and cardiovascular disease (Dietz, 1998; Raychaudhuri & Sanyal, 2012). The importance of positive health experiences with healthy foods such as fruits and vegetables (FV) are even higher for children from low-income families who are at an increased risk for childhood obesity than the general population (Kaphingst & Story, 2009; Hughes et al., 2010). Furthermore, children from low-income households spend 30+ hours a week in childcare (Burstein & Layzer, 2007) where they consume between 50-75% of their daily dietary intake (Frisvold & Lumeng, 2011). Thus, preschool is an ideal setting, and teachers an important partner, to expose children to positive experiences with healthy foods (Burstein & Layzer, 2007; Li et al., 2010). Exposing children to healthy foods occurs any time the food is presented to children in any form (mealtime, science experiment, book, photographs etc.)

Head Start (HS) is a federally funded preschool program that serves low-income children and their families in the US (Office of Head Start, 2016). Each year, HS strives to meet the emotional, social, health, nutritional and psychological needs of the one million low-income preschoolers (3–5-year-old's)

they serve nationwide (Office of Head Start, 2016). HS began in in 1965 on the basis of the "war against poverty" and is housed under the US Department of Health and Human Services (Currie & Thomas, 1995). To be qualified for HS, a family's household income must be less than 100% of the federal poverty level that is determined by number of people living in a household (Office of Head Start, 2016). HS's central goals include preparing children for kindergarten through education, health, and social services (Office of Head Start, 2016).

To address school readiness concerns, HS's Early Learning Outcomes Framework (ELOF) provides an overview of the skills, behaviors and knowledge that programs should teach children prior to kindergarten. The framework is organized into five elements: domains, sub-domains, goals, developmental progress, and indicators. Each element is informed by comprehensive bodies of research in the early childhood development field. The domains are broad areas of early learning and development that HS considers essential for kindergarten readiness. In total, there are five domains: 1) Approaches to Learning; 2) Social and Emotional Development; 3) Language and Literacy; 4) Cognition, and 5) Perceptual, Motor, and Physical Development (Head Start Early Learning Outcomes Framework, 2020).

While the services and education that HS provides are essential to establish positive academic and health behaviors in young preschool-age children, approximately one in every three children in HS are categorized as overweight or obese with a BMI at or above 85th percentile (Hughes et al., 2010). One explanation is that fruit and vegetable (FV) consumption among preschool aged children is lower than the daily recommended five servings (Swindle et al., 2018). However, children from low-income families may have even lower access to healthy foods, such as FV, and consume more refined, highly processed, calorically dense, foods (Swindle et al., 2018).

To combat childhood obesity and poor eating habits, classroom-based methods that increase familiarity and create positive experiences with healthy foods can result in increased willingness to taste healthy foods and improve overall dietary intake among preschoolers (Batties-Fries et al., 2017; Dazeley, Houston-Price & Hill, 2012; Perez-Rodrigo & Aranceta, 2001). Classroom-based methods to improve children's willingness to try and consume healthy foods include incorporating healthy foods into the mealtime (Bayles et al., 2020; Whiteside-Mansell et al., 2019), creating a positive mealtime environment (Dev et al., 2019), or exposing children to healthy foods outside the mealtime through activities such as

gardening, books, and science experiments (Cooke, 2007; Sullivan & Birch, 1990). While many teachers consider mealtime as an opportune time to talk about food because foods are naturally present, some teachers find mealtime environments chaotic and are often preoccupied with other tasks, making nutrition education difficult (Dev et al., 2017). For this reason, exposing children to healthy foods outside the mealtime through activities such as gardening, science experiments, and other hands-on experiences has been suggested to be the most effective way to increase children's' exposures, or experiences with, healthy foods (Contento et al., 1995).

Using food as a teaching tool in the classroom, outside of the mealtime environment, has been termed food-based learning (FBL) (Carraway-Stage et al., 2015). When children are allowed to explore FV outside the mealtime, the development of children's healthy eating behaviors are supported by exposing children to healthy foods and expanding their food preferences and consumption (Bayles et al., 2020; Johnson et al., 2019; Sandell et al., 2016; Whiteside-Mansell et al., 2019). For example, over the course of a week a teacher could read a book about how carrots grow, design a classroom experiment to watch carrots grow roots in water, use a ruler to measure and document how long a carrot is and then have children engage their senses by touching, feeling, smelling, listening to and tasting carrots. These FBL activities would provide children with continuous exposures to carrots using a multitude of learning domains such as science, mathematics, literacy and language outside of the mealtime environment.

While FBL is considered the most effective way to increase children's preference and consumption of vegetables (Contento et al., 1995; Whiteside-Mansell, Swindle, Davenport, 2019), teachers face barriers when implementing FBL in the classroom such as time and competing priorities, making the integration of FBL with other learning domains a promising solution (Carraway-Stage et al., 2014). While integrating FBL with other learning domains has been cited as a method to overcome teacher barriers, only two studies have examined dietary outcomes of FBL but neither study examined FBL's impact on academic outcomes (e.g., science, mathematics, literacy) (Bayles et al., 2020; Johnson et al., 2019), leaving a critical gap in the understanding of its potential. Additionally, both aforementioned studies employed quantitative methodologies, thus lacking qualitative perspective. Furthermore, FBL was previously a requirement in HS, but has recently been changed from a requirement to a suggestion.

Therefore, to the authors' knowledge no studies have since explored how FBL is *currently* being integrated with other learning domains, such as cognition or language, in the HS classroom.

The cognition learning domain, which encompasses preschool scientific reasoning, is, in particular, a key area for integration as engaging children in early science learning is indicative of future academic achievements (Cabell et al., 2013; Straits, 2018). Science learning provides a natural foundation for hands-on, science learning related to living things (e.g., humans, animals, and plants), their relationships with one another, and how to care for our bodies and other living things (e.g., healthy eating, animal/plant life cycle). The science environment has the ability to improve children's language, literacy, and mathematics skills (Gelman et al., 2009), while also serving as a platform to expose children to healthy foods through experimentation and exploration (Bayles et al., 2020). Additionally, as preschoolers cognitively mature, the skills developed through high-quality science learning will enable them to use acquired science knowledge to make positive choices about their personal health and living things in their environment (Nayfeld, Brenneman, Gelman, 2011; Sigman-Grant et al., 2014; Carruth et al., 2000). Further exploration of the characteristics and use of FBL (e.g., quality of activities), and their integration with other learning domains, such as cognition and language, will move the field of nutrition forward by gaining understanding of the critical components of effective FBL that will reduce teacher barriers, improve teacher practices, and promote positive academic and health outcomes for children.

## Statement of Problem

The preschool years (3 to 5 years old) are critical to establish healthy dietary behaviors that carry children through adulthood; however, HS teachers frequently face barriers limiting their ability to expose children to healthy foods in the classroom (e.g., limited time, limited resources, lack of support, conflicting priorities). Integrating FBL into other school readiness domains, such as science, has been cited as a method to address these barriers and promote future academic success. To fill this gap, this study will investigate teachers' experiences with the *current* general use (post policy change removing FBL as a requirement) and integration of FBL with other learning domains, such as cognition and language, in HS classrooms across NC using a qualitative approach.

## Statement of Purpose

In this study, NC HS teachers' experiences using and integrating FBL in their classroom will be studied. A qualitative method design will be used to guide the study. The in-depth, semi-structured interviews will explore the phenomenology, or common lived experience, of HS teachers' use and integration of FBL in their classrooms. The purpose of this phenomenological study is to explore HS teachers' experience using food as a teaching tool in the classroom and integrating food into other learning domains, such as cognition and language, in the classroom. A qualitative design will be utilized for the present study. Qualitative research provides detailed perspectives of participants and is told from their viewpoint. Phenomenology allows for understanding of the *what* and *how* of teachers' experiences (Bowen, 2008; Moustakas, 1994; Creswell, 2012; Creswell, 2013).

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# CHAPTER 2: LITERATURE REVIEW

## Dietary Quality Among Preschool Children in the United States

Preschool aged children's dietary consumption is of concern with between 25-30% of children not consuming vegetables daily (Johnson, 2016). Additionally, vegetables that are commonly consumed are not vegetables rich in nutrient sources, such as dark leafy greens, rather potatoes (Fox et al., 2010). In fact, children's consumption of vegetables throughout the first five years of life are lowest during the preschool years (Grimm et al., 2014). Children from low-income families are even more vulnerable to have low FV intake (Darmon & Drewnowski, 2008; Hughes et al., 2010). Low FV intake in childhood is correlated with increased risk for disease later in life (Boeing et al., 2012). The preschool years are therefore critical for establishing positive health behaviors because although children do not decide what food is available to them, they are beginning to learn how to make their own health decisions (Gripshover et al., 2013; Sigman-Grant et al., 2014) and recognize what constitutes as healthy choices (Sigman-Grant et al., 2014; Carruth et al., 2000; Lanigan et al., 2011). These health experiences matter as the habits children establish at this age will impact their health status into adulthood (Cashdan, 1994; Dwyer, Suitor & Hendricks, 2004; Skinner et al., 2002).

## Determinants of Fruit and Vegetable Consumption

### Biological

Many factors, at a variety of different levels, including interpersonal, intrapersonal and environmental, interact to impact vegetable intake in young children (**Figure 1**) (Johnson, 2016). Children begin developing food preferences as early as in utero and continue developing experiences and preferences during breast feeding, long before introduction to solid food (Beauchamp & Mennella, 2009). Long-term breast feeding has been suggested to increase FV consumption later in infancy (Deming, Briefel & Reidy, 2014; de Lauzon-Guillain et al., 2013). As children begin to consume food, both timing and variety can impact their acceptance; however, future research is needed to understand optimal conditions for FV acceptance in young infants and toddlers (Coulthard, Harris & Emmet, 2010; Shim, Kim & Mathai, 2011; Nicklaus, 2009). Regardless of these early experiences, once children reach preschool years (3-5 years old), encouraging them to try new foods can be difficult for parents and early childhood

teachers because neophobia, or “fear of the new”, is heightened during preschool years (Dovey et al., 2008). At this age, children prefer and consume more energy dense foods that tend to be sweet or salty (Cooke, Wardle & Gibson, 2003). When encouraging preschool children to consume FV, children have a natural predisposition to favor fruits since they have natural sweetness (Birch, 1999), compared to vegetables that often have a bitter taste profile (Skinner et al., 1999; Nickalus et al., 2005).

**Relational - Parents**

In addition to biological development of preferences, children’s’ relationship with adults, albeit parents or early childhood teachers, also influence their FV consumption. Since young children do not dictate what foods are available to them at school and home, adults serve as role models for eating behaviors that children emulate (Larson & Story, 2009). Prior research suggests that parents who model healthy eating themselves can improve their children’s’ consumption of FV (Galloway et al., 2005; Larson & Story, 2009; Busick et al., 2008). Having an adult role model helps children feel supported in their learning of new experiences (Bustamante et al., 2017). Prior research also suggests that the presence of a trusted adult role model who enthusiastically tries a new food, improves the chance that the child will also try it (Harper & Sanders, 1975). Parents and caregivers may become frustrated with the preschool children’s neophobic behaviors (e.g. continual refusal of food) and respond by offering healthy foods less often and/or use pressuring strategies to try and coerce the child to consume vegetables which may negatively impact FV consumption (Galloway et al.2005; Kaar, Buti & Johnson, 2014; Gregory, Paxton & Brozovic, 2011).

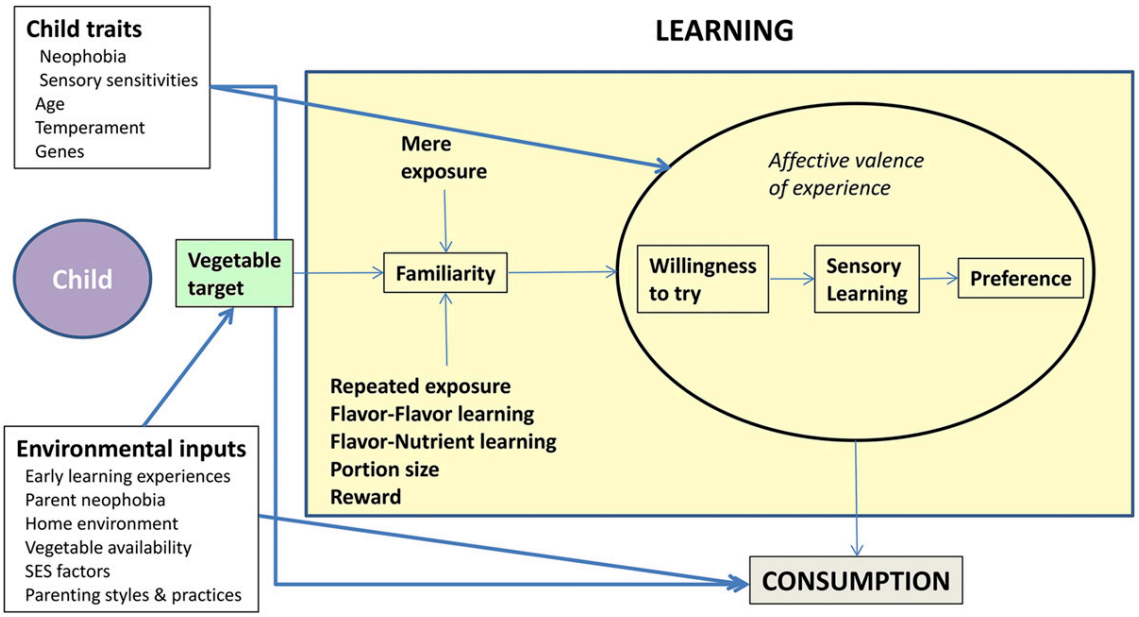


**Figure 1.** 2-Stage model of the development of children's vegetable preferences and consumption as presented by Johnson (2016).

**Relational – Early Childhood Teachers**

Effective role modeling and strategies related to FBL are equally important for early childhood teachers as children consume the majority of their daily meals/snacks at preschool (Frisvold & Lumeng, 2011). At HS, meals are served "family style", foods are passed around the table and children serve themselves with guidance from teachers (Office of Head Start, 2014). Per HS policy, children and teachers sit at the same table and eat the same foods in an effort to promote positive adult role modeling and increase children's vegetable intake (Kharofa et al., 2016; Blaine et al., 2015). A prior qualitative study seeking to understand HS teachers' attitudes towards mealtimes and portion sizes found that teachers modeled healthy eating behaviors and encouraged children to try new foods by explaining how much they liked the healthy food (Goodell et al., 2010). These strategies, such as enthusiastic teacher modeling and verbal praise, have been shown to increase children's food acceptance (Hendy & Raudenbush, 2000).

However, other studies have found less beneficial food-related practices in the HS classroom. For example, a longitudinal study consisting of 75 childcare providers found that teachers often lacked knowledge about healthy practices regarding foods in the classroom, that led teachers to pressure

children to eat while failing to role model properly (Lanigan, 2011). Another study by Swindle and colleagues (2017) identified 3 factors that impacted teachers' food-related behaviors in the classroom: Rules and Routines, Leave a Health Legacy, and Food Insecurity. Early childhood teacher's prior history with food experiences (e.g. how meals were done as they were growing up) dictated the rules and routines that they tried to instill in their students during mealtime. Teachers desired to see children establish better dietary habits than they did as children inspiring them to "Leave a health legacy" through the food-related experiences they provided. Lastly, teachers worried about children's food security, often encouraging children to eat when not hungry and/or offering them increased amounts of food due to perceived food insecurity in the child's home. Other studies have also indicated that HS teachers' fears of child food insecurity impacts their behaviors during mealtime (Sigman-Grant et al, 2008; Gooze, 2012). One study found that 56% of ECE knew they had children in their classes who were hungry, leading them to give them extra food while at school (Sigman-Grant et al, 2008) or "clean their plate" (Gooze 2012).

**Environmental**

Teachers' fears of children's food insecurity are not unmerited as children from low-income households may have decreased access to food in their homes (Gooze 2012). It has been estimated that one-third of children entering HS come food insecure households (Nord et al., 2010). In such households, there may be decreased access specifically to vegetables since vegetables may be perceived as costly and require preparation techniques that low-income families may be unfamiliar with (Cullen et al., 2003). However, although children are not guaranteed access to vegetables in the home, they do have guaranteed access to FV at school. As a federally funded program, HS centers are required to follow federal performance standards and use funds from the US Department of Agriculture (USDA) to purchase meals and snacks via the Child and Adult Care food Program (CACFP). Provded centers follow CACFP nutrition guidelines for nutrients and portion sizes, such as the provision of vegetables at meals and snacks, CACFP will reimburse programs for food (Child and Adult Care Food Program, 2017). Impacting children's health behaviors regarding vegetable preference and consumption is vital so that when healthy foods, such as vegetables, are available in the school environment, they are accepted and consumed by preschool children (Bayles et al., 2020).

## Methods for Improving Vegetable Intake

**Repeated Exposure**

There is a saying that children “like what they know and eat what they like” (Cooke, 2007). While this statement is true, one way to get children to “know” new foods is through repeated exposure (Sullivan & Birch, 1990). Repeated exposure consists of providing children with the opportunity to experience healthful foods, multiple times, in multiple different forms, to increase familiarity of a food. Although other methods for improving vegetable consumption in children have been studied such as flavor-flavor learning (Heath, Houston-Price, & Kennedy, 2011), flavor-nutrient learning, (Heath, Houston-Price, & Kennedy, 2011), manipulation of portion size (Krall & Hetherington, 2015), and rewards (Heath, Houston-Price, & Kennedy, 2011; Krall & Hetherington, 2015), repeated exposure is suggested to be the most effective method for impacting both preference and consumption is repeated exposure (Sullivan & Birch, 1990). Specifically, children need 8-15 exposures to increase liking of a new food (Sullivan & Birch, 1990; Johnson et al., 2007). Further, it is recommended that exposures should occur both inside and outside the mealtime environment (Whiteside-Mansell, Swindle, Davenport, 2019).

**Mealtime**

Children are exposed to healthy foods during mealtimes. Teachers can create a positive mealtime environment by role modeling healthy eating (Hendy & Raundebush, 2000), encouraging children to explore food using their five senses (Hoppu et al., 2015), and providing verbal praise (Cooke et al., 2011). For example, teachers should positively describe their experience eating healthy foods and encourage children to share their thoughts with each other as well (Dev et al., 2019). Teachers can also improve children’s consumption of healthful foods by engaging in responsive feeding that encourages children’s innate self-regulation (Blaine et al., 2015). These feeding practices encourage children to have autonomy in their food experiences and encourage consumption of healthful foods (Dev et al., 2019). While these feeding practices are ideal to impact FV consumption in preschool children, teachers are often distracted during mealtimes (Ramsay et al., 2010; Lumeng et al., 2008; Dev et al., 2017), decreasing the quality of feeding practices and positive food experiences (Gable et al., 2001; Ramsay et al., 2010). Additionally, food exposures during the mealtime are often chaotic and children may feel heightened pressure to taste the food, rather than explore it with their other senses, which is often even discouraged during mealtimes as “poor table manners” (Carruth & Skinner, 2000; Orrell-Valente et al.,

2007). Lastly, teachers have been observed applying coercion and pressure to encourage children to eat healthy foods. These practices generally result in the opposite behavior and have been associated with negative child health outcomes such as childhood obesity (Dev et al., 2013; Ventura & Birch, 2008).

### Outside the Mealtime

For these reasons hands-on learning, outside of the mealtime, that engages children's' natural curiosity, is an ideal way to increase children's' exposure to healthful foods. When children are encouraged to explore foods through hands-on learning, the development of children's healthy eating behaviors are supported by exposing them to unfamiliar foods and ultimately expanding their food preferences (Sandell et al., 2016). Classroom-based methods that increase familiarity and create positive experiences with healthy foods can result in increased willingness to taste healthy foods and overall improved dietary intake among preschoolers (Batties-Fries et al., 2017; Perez-Rodrigo & Aranceta, 2001). Specifically, FBL or the use of food as a teaching tool in the classroom (Carraway-Stage et al., 2015), has been theorized as an effective method for improving children's eating behaviors through positive exposures with healthy foods (Bayles et al., 2020; Johnson et al., 2019; Swindle et al 2017). HS has identified FBL as a common educational approach. Prior research has cited cooking, ranging from basic food preparation (e.g., ants on a log) to actual cooking (e.g., soup), (Hersh et al., 2014; Carraway-Stage et al., 2014; Dev et al., 2018) and gardening (Heim, Stang & Ireland, 2009; Robsinon-O'brien et al., 2009) as common FBL strategies. Additionally, by garnering hands-on learning outside of the mealtime, children are free to engage in multisensory learning without the stress of needing to taste the vegetable (Nekitsing et al., 2018).

## The "What" and "Why" of Food-based Learning

### Benefits of FBL

The benefits of FBL include providing exposure to healthy foods in a less stressful environment (Nekitsing et al., 2018) while encouraging children to use their five senses to explore foods (Whiteside-Mansell & Swindle, 2018) which may not be encouraged during mealtime (Carruth & Skinner, 2000; Orell-Valente et al., 2007). Integrating FBL with other learning domains such as cognition and language is a unique opportunity for preschool teachers to engage children across multiple school readiness domains while exposing children to new foods and nutrition education (Bayles et al., 2020; Johnson et al., 2019).

Additionally, integrating FBL with learning domains has been cited as a method to reduce identified barriers that HS teachers face, such as time constraints and competing priorities, which often impact the quantity and quality of nutrition education provided (Carraway-Stage et al., 2014). Integrating FBL with these school readiness domains as a way to teach foundational academic concepts has been cited by HS teachers as a way to reduce such barriers (Carraway-Stage et al., 2014; Dev et al., 2017). Science in particular is an ideal subject to integrate with FBL since children's attitudes about science and their confidence in their ability to "do" science is established at an early age (Early STEM Matters, 2018). With HS's mission of kindergarten readiness, and research suggesting early science learning can be indicative of future academic success (Duncan et al., 2007; Straits, 2018), the integration of science and FBL is promising. Additionally, FBL has the potential for possible co-benefits such as reinforcing young children's fine/gross motor skills (Bellows, Davies, Anderson & Kennedy, 2013; Story et al., 2008) and promoting early literacy (Droog, Buijzen, & Valkenburg, 2014; Heath, Houston-Price, Kennedy, 2011).

**Prior FBL Interventions & Outcomes**

Prior interventions that expose preschool children to healthy foods in the classroom through the use and integration of FBL have shown promise in increasing FV consumption (Bayles et al., 2020; Whiteside-Mansell et al., 2019) and impacting the environment (Whiteside-Mansell, Swindle, Davenport, 2019). A few of these studies are described below.

Integrative FBL intervention, *Together, We Inspire Smart Eating* (WISE) is an 8-month nutrition education curriculum designed to increase children's exposure to FV through weekly hands-on exposures using foods that are readily available in the school and home environments (Whiteside Mansell., 2019). The WISE curriculum encourages children to use their senses to explore FV and includes recipes that children can help prepare. The curriculum was created to be integrated during regular classroom activities (e.g., circle time). An example of an integrative FBL WISE activity is creating skewers using spinach, tomatoes, and mozzarella cheese to create predetermined patterns, a common mathematical concept. Outcomes of the WISE study indicated a significant increase in vegetable consumption among children in the intervention (M=3.44, SD=1.23) at post-test as reported by parent-reported food frequency questionnaires. Additionally, the study used resonance Raman spectroscopy (RRS) which measures the levels of carotenoids in the blood, indicative of FV consumption, to measure children's FV consumption

(Ermakov, 2001). Children in the intervention had significantly higher RRS scores at post-test compared to baseline (t(263)=-.08 $p$<.039) (Whiteside Mansell, 2019).

Bayles et al. (2020) also observed positive outcomes for FV consumption as a result of hands-on FBL activities in preschool classrooms. Their intervention consisted of 7 hands-on Science, Technology, Engineering, Arts and Mathematics (STEAM) FBL activities implemented over the course of 4 months. The intervention featured 9 target vegetables (broccoli, cauliflower, sweet potato, cucumber, tomato, carrot and pea pod) chosen based on prior exposure as determined by parent report, and/or the potential of the food to influence skin carotenoid status. The activities were 15-20 minutes and included circle time (group discussion) and a hands-on activity integrated with a science, mathematics, and/or language concept. Children were given the opportunity to taste the featured target vegetable at the end of each lesson and were encouraged to continue to explore the food with their other senses. An example integrative FBL from this program includes exploring chlorophyll that makes broccoli green by steaming broccoli. Outcomes of the intervention revealed children in the intervention group consumed significantly more carotenoid rich FV than the control ($F_{1,77}$=3.98; $p$=.02, r=.10) (Bayles et al., 2020).

**FBL Best Practices**

The following section outlines best practices for using FBL in the preschool classroom. Previous papers have attempted to discuss FBL best practices but have mainly emphasized exploring food with the senses (Netkitsing et al., 2018) or the mealtime environment (Dev et al., 2019). No papers to the authors knowledge have specifically described the full range of best practices for FBL; this is an area for future study.

***Incorporate Healthy Foods***

Engaging children in integrated FBL has the potential to prepare children for kindergarten, while also promoting healthy consumption of FV (Whiteside-Mansell & Swindle, 2018; Johnson et al., 2019; Shilts, Lamp, Horowitz & Townsend, 2009). When providing food experiences in the classroom, the inclusion of FV is ideal, compared to other foods, because preschool children do not consume the recommended amount of daily FV (Grimm et al., 2014; Vernarelli et al., 2011). Instead, preschool children consume high-calorie food with little nutritional benefits such as sugary foods and snacks (Lorson, Melgar-Quinonez & Taylor, 2009). FV provided should also be culturally appropriate to the demographics

of preschool children (Office of Head Start, 2015). Additionally, prior research suggests that teachers use unhealthy foods during activities in the classroom, further emphasizing the need to incorporate healthy foods instead (Swindle & Phelps, 2018).

***Multiple Exposures***

Providing children with multiple exposures in an environment where children are not pressured to eat the food, such as outside the mealtime, are necessary to improve liking and consumption of FV (Johnson et al., 2007; Sullivan & Birch, 1990). Prior research suggest 8-15 exposures are needed for a new food (Johnson et al., 2007; Sullivan & Birch, 1990). However, there is limited research for the necessary exposures for a familiar vegetable that a child has already had exposures to. In a prior study, it was hypothesized that improving children's' liking for a new vegetable may be easier since children do not have a predisposed disliking (Birch, 1998). For this reason, teachers should not be discouraged after children reject a given vegetable since it takes persistence and repeated exposure to overcome these neophobic barriers (Carruth & Skinner, 2000; Maier et al., 2007). Teachers' dedication to providing continued exposures to healthy foods in the school environment is especially important since parents may be less persistent in offering previously rejected foods at home (Carruth & Skinner, 2000; Maier et al., 2007).

***Engage the Senses***

Instead of pressuring children to eat the food which has been shown to have negative outcomes (Osborne & Forestell, 2012), teachers should encourage children to explore the food with their other senses (Hoppu et al., 2015). This can lead to future acceptance of that food (Nekitsing et al., 2018). Prior interventions aimed at multisensory FBL experiences, have observed increases in children's FV acceptance (Dazeley & Houston-Price, 2015; Hoppu et al., 2015). Additionally, prior interventions specifically targeting visual exposures to FV via books and posters have been observed to increase preference and consumption of FV (Heath, Houston-Price & Kennedy, 2011; Osborne & Forestell, 2012). While teachers encourage children to explore foods with their senses, tasting should not be over-emphasized. Teachers should avoid using rewards as contingencies to get children to try vegetables (e.g., "You can have a cookie only if you finish your peas"). This feeding practice has been suggested to lower vegetable consumption in children (Blissett, 2011; Kiefner-Burmesiter et al., 2014). Other studies

suggest that using bribery and rewards may in the short-term improve consumption, but it will not improve long-term liking of the vegetable (Birch, Birch, Marlin & Kramer, 1982; Birch, Marlin, & Rotter, 1984).

### *Do Not "Play" with Food*

One-third of children entering HS come from food insecure households (Nord et al., 2010). Teachers are often aware of this fact and may have concerns about using food for learning activities (Sigman-Grant et al, 2008; Gooze, 2012). For this reason, food presented in the classroom as a learning tool, such as during FBL, should always be available to be consumed after the learning activity has ended (Office of Head Start, 2015). For this reason, using food in the sensory table and/or food materials as construction to the point that they are no longer suitable for consumption should be avoided (Office of Head Start, 2015).

### *Role Model and Respect*

On the other hand, when food is provided for tastings, teachers should respect children's decision about whether or not they desire to eat the food. (McBride & Dev, 2014). Encouraging children to eat food when they have stated they are no longer hungry teaches children to ignore their innate internal cues of hunger and fullness (McBride & Dev, 2014). Teachers can be good role models of acknowledging personal signs of hunger and fullness by verbalizing their feelings when with children (e.g., "My tummy is full now, I am going to stop eating now!") (Dev et al., 2019).

### *Family Engagement*

Additionally, teachers should look for ways to engage families. Parents who model healthy eating themselves can improve their children's' consumption of FV (Galloway et al., 2005; Larson & Story, 2009; Busick et al., 2008). Prior research suggests that while children do not purchase the food available in the home, they can advocate for change based on their experiences at school (e.g., "We had carrots at school today, they were yummy, can we get carrots from the store?") (Stage et al., 2020). Families and the community help to bridge the gap between school and the outside world. Their engagement promotes learning and encourages children to make discoveries and healthy choices on their own (Straits, 2018).

## Barriers to FBL

### *Resources*

Providing preschool children with the proper classroom environment is key to promote exploration. Classrooms area should include materials that children can independently explore (Harper-Whalen & Spiegle-Mariska, 1991; Kostelnik et al., 2004). It is recommended to have FBL materials handy such as measuring cups, pots/pans, cutting boards, strainers (Tu, 2006). However, it is important to note that FBL can be integrated into any learning domain (e.g. mathematics, literacy, science) and so materials are not exclusive. Prior research suggests that teachers do not feel they have adequate resources, both material and financial, for FBL which limit their ability to use food in the classroom as a teaching tool (Carraway-Stage et al., 2014). Stage et al. (2014) also describe that teachers faced barriers such as limited funding as a reflection of low priority for FBL in the classroom and cited funding for nutrition-related activities as their area of highest need. Other studies have also found that funding is a significant barrier to health education (Gupta et al., 2005; Hughes et al., 2010).

***Influence of Policy***

Engaging children in food experiences, during mealtimes and outside of mealtimes, are subject to HS policy. HS programs are regulated by federal performance standards (Office of Head Start, 2015). These standards outline expectations for children's development cognitively, socially and physically. Regarding nutrition-related policies, the Performance Standards (1304.23) outline practices for appropriate child feeding practices, nutrition education, and provision of meals and snacks (Office of Head Start, 2015). To provide healthy foods to their children, HS programs participate in *CACFP* or the *National School Breakfast Program* (Office of Head Start, 2015). While federal performance standards require HS programs to use FBL in the classroom help young children develop positive eating habits (Briley & Mcallaster, 2011; Lumeng, 2008; Maher, 2008), research suggests that such policies in the food environment have led to excessive administration burden on teachers and staff as well as general uncertainty (Carraway-Stage et al., 2014; Kaphingst & Story, 2009; Peterson et al., 2017). More specifically, the overwhelming number of policies surrounding FBL, and their subsequent lack of clarity, has been suggested to cause confusion for teachers and inhibit the likelihood and quality of FBL in the classroom (Peterson et al., 2017). In one instance, state sanitation policies regarding FBL through cooking in the classroom have been misinterpreted by local centers to prohibit such FBL activities. Other Policies like "no outside food", intended to prohibit unhealthy food from entering the classroom, have

been interpreted to prohibit all food, inhibiting FBL such as taste testing novel FV. These misinterpretations cause infrequent FBL activities and lower teacher efficacy, which hinders food experiences children can have in the classroom and ultimately their long-term dietary quality (Peterson et al., 2017).

### *Other Challenges*

In addition to challenges regarding food-related policy, HS teachers face other challenges when trying to implement FBL in their classrooms. Prior research suggests teachers may feel they are not well-equipped to teach the subject matter and/or lack professional development (Cotugna & Vickeryn, 2012). Further, time constraints and pressure to complete all necessary materials often left teachers feeling they did not have time for FBL or nutrition education (Stage et al 2014). Therefore, teachers may need assistance in learning to integrate nutrition materials into the daily classroom and kindergarten readiness topics such as Science, Technology, Engineering, and Mathematics (STEM) (Scherr, 2011). The time and means to attend professional development opportunities may be key to overcome these cited barriers (Carraway-Stage et al., 2014).

### *COVID-19*

Lastly, the severe acute respiratory syndrome, coronavirus disease (COVID-19), has become a significant barrier to FBL in the preschool classroom. COVID-19 first appeared in Wuhan, China at the end of 2019 (Holshue et al., 2020; Zhu et al., 2021). The highly infectious disease can be transmitted person-to-person and its first recorded case in the US occurred on January 20, 2020 (Harcourt et al., 2020). To date, over 21 million and 578,000 people in the US and NC have contracted COVID-19, respectively (World Health Organization, 2020). Additionally, over the course of a 3-week period in March 2020, more than 16 million people filed for unemployment (Blustein et al., 2020). Beyond the vast economic implications of the disease, in NC, on March 16, 2020 schools state-wide were ordered to closure for the academic year to reduce the COVID-19 spread (Education Week, 2020). The unprecedented closure of schools statewide, including HS preschool centers, have created greater stress for children and families. Low-income children, such as those enrolled in HS, have been disproportionately affected by the closure of childcare centers as many of these children rely heavily on

school services for nutritional, physical and mental needs (Masonbrink, 2020). As such, there has been widespread concern for low-income children's food insecurity (Masonbrink, 2020).

Responses to food-insecurity have included increased access to nutrition programs such as Supplemental Nutrition Assistance Program (SNAP), emergency allotments and Pandemic-Electronic Benefit Transfer, grocery vouchers, and "to-go" meals from educational centers. However, it is estimated that only 11% of newly unemployed, low-income families reported access to such "grab-and-go" meals (Ananat, 2020). Prior research in April of 2020 found that 35% of households with children under the age of 18 are now food insecure, which is double the rates found in 2018 (Wozniack, 2020). Academically, it is estimated that COVID-19 closures and changes within the early childhood environment will lead to lower test scores, lower educational attainment, and decreased earning potentials (Psacharopoulos, 2020).

As HS centers begin to reopen during the COVID-19 pandemic, new measures such as daily health checks, personal protective equipment, cleaning, sanitizing and disinfecting, and group size and ratio measures have been put into place (Centers for Disease Control, 2020). However, lack of understanding on the incubation and transmission of COVID-19 among young children, as well as the financial strain that implementing all recommended steps for childcare, has made reopening difficult and in some cases impossible. For centers that are reopened, additional concerns about the transmission of COVID-19 via food and/or concerns about food sharing are barriers in the FBL environment (Pressman & Clemmons, 2020). More research is needed to understand both the short and long-term impacts of COVID-19 on childcare centers such as HS and the children and families they serve (Hashikawa er al., 2020).

**Gaps in Research**

FBL in the classroom has been theorized as an effective method for improving children's eating behaviors through positive exposures with healthy foods. However, FBL in the classroom has often been underutilized due to barriers such as time and competing priorities (Carraway-Stage et al., 2014). While integrating FBL with other learning domains has been cited as a method to overcome teacher barriers, only two studies to the authors knowledge have examined this impact (Bayles et al., 2020; Johnson et al., 2019), leaving a critical gap in our understanding of its potential. Science in particular is an ideal subject

to integrate with FBL since children's attitudes about science and their confidence in their ability to "do" science is established at an early age (Early STEM Matters, 2018). Further, prior research suggests that early science learning can be indicative of future academic success (Duncan et al., 2007; Straits, 2018). To date, only three studies have partially described teacher-led FBL in the preschool classroom as reported through broader research questions related to nutrition education (Carraway-Stage et al., 2014; Dev et al., 2018; Swindle & Phelps, 2018). However, these studies were conducted qualitatively and lacked quantitative context. Additionally, to the authors knowledge, none of these studies have explored how FBL is being integrated with other learning domains, such as science. Further exploration of the characteristics and use of FBL (e.g., quality of activities), and their integration with learning domains, will move the field of nutrition forward by gaining understanding of the critical components of effective FBL that will reduce teacher barriers, improve teacher practices, and promote positive academic and health outcomes for children.

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# CHAPTER 3: METHODS

## Research Design

This study will explore NC HS teachers' experiences using and integrating FBL in their classrooms. A qualitative method design will be used to explore the phenomenology, or common lived experiences, that NC teachers have with FBL. Prior to the start of data collection, East Carolina University's Institutional Review Board will review and approve all study protocols and instruments.

## The Larger NIH SEPA Study

The present study is a part of a larger needs assessment study being conducted at the state-level to assess the specific needs, assets, and resources of partner HS programs to inform the development of teacher professional development resources for the Preschool Education in Applied Science (PEAS) Institute for Early Childhood Teachers. PEAS is a five-year grant funded by a National Institutes of Health (NIH) National Institute of General Medical Sciences (NIGMS) Science Education Partnership Award (SEPA). The overall aim of PEAS is to create a teacher professional development intervention that aims to (1) build teachers' science teaching efficacy and pedagogical knowledge and skills; and (2) improve children's science knowledge, development of scientific language, and dietary quality. The needs assessment study at large will help to provide context for program needs, inform program and behavioral theories that will guide curriculum development, identify existing resources and infrastructure in HS across the state and identify key stakeholders and gain momentum for intervention, evaluation, and sustainability. The proposed study will represent a subset of the larger needs assessment data.

## Subject Population and Eligibility

Eligible study participants will be current employees of a HS-funded organization in NC. All participants must be 18 years of age or older and currently serving in the role of a Teacher (Lead or Assistant).

## Recruitment

Teachers will be recruited from HS organizations throughout the state of NC. To recruit teachers, researchers will use a comprehensive list of HS funded organizations and their affiliated centers as the sampling frame (**see Figure 3**). The research team will contact all organizations to ensure representation

by location and organization type. There are 354 centers within 52 funded HS organizations in NC (Head Start NC, 2021). Researchers will contact the education manager of each HS grantee via phone or email to obtain permission prior to communicating with HS teachers (**Appendix A)**. HS Program Directors may also be contacted and asked to post details about the study on their internal webpage and/or Facebook page (**Appendix B**). However, HS Directors will be unaware of which individuals in their organization ultimately volunteer to participate in the study.

Once permission is obtained, HS Teachers within each organization will be recruited by email (**Appendix C**). Teachers who agree to participate will provide electronic consent (**Appendix D**) and complete a brief demographic questionnaire online. At completion of the survey, teachers will be asked if they are interested in scheduling an individual interview with the research team to further discuss their experiences with food in the classroom. Interviews will only be conducted with teachers who have expressed interest in participating. Researchers will confirm completion of the survey and consent prior to conducting the interview.

Using the recruitment technique of snowballing, participating teachers will be asked to recommend and/or forward information to other potential study participants (Valerio, 2016). The estimated sample size is approximately 30 or until saturation is reached (Bowen, 2008). A minimum sample size of 10 is considered appropriate for qualitative research (Creswell, 2013). Saturation occurs when collection of new data does not yield novel information about the phenomenon being studied (Bowen, 2008).

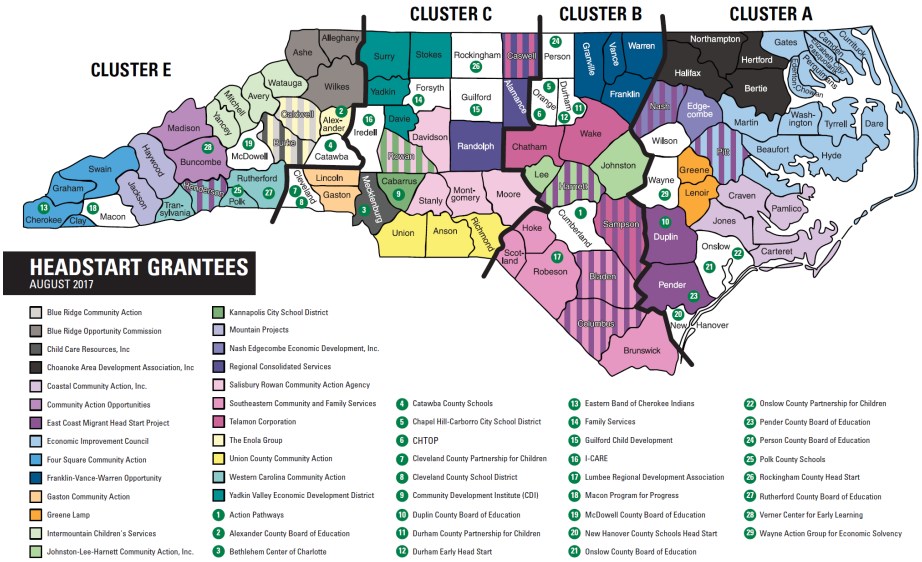


**Figure 2. Head Start Grantees Across North Carolina**

## Data Collection and Tools

Interviews were chosen as the ideal form of data collection because they will comfortably engage HS teachers to share their personal experiences in their classroom. The interview guide will be designed to address the primary research questions using an iterative process which is a non-linear, reflexive process that consists of multiple rounds of revisiting data and collection materials to develop insight and meaning (Srivastava & Hopwood, 2009). Questions will be developed in collaboration with an experienced research team consisting of three Nutrition Science faculty/Registered Dietitians and three Nutrition Science graduate students who are informed by personal experience and observation of the problem in the field. Multiple revisions of the guide, led through group discussions, will be completed to prevent leading questions and to keep the guide focused on the subject matter. The interview guide will also be piloted by at least three preschool teachers prior to data collection. If a recruited teacher is currently employed by an NC-based HS program, this individual will not be considered part of the official sample size.

Overall, the interview guide will be designed to include major questions intended to facilitate open ended discussion, in addition to specific probes to clarify participant responses and gain depth on interview topics. The interview guide examines teachers' current classroom practices related to the use and integration of FBL in the classroom (**Table 1**). As the interview guide progresses, questions become

more focused to examine teachers' opinions and motivations toward teaching science and integrating food experiences with preschool-age children, as well as teachers' perception of needed changes (**Appendix F**). Since the proposed study is a part of a larger study, interview questions that will be analyzed for the present study pertain only to FBL and the integration of FBL into other learning domains (e.g., science).

All interviews will be conducted over the phone. The interviews will be recorded using the Rev App call recorder using university-owned electronic devices (e.g., iPad). Rev will also be used to transcribe audio recordings verbatim for data analysis. Findings from interviews will be analyzed to identify key themes regarding food experiences in the science learning and classroom environment (Bound, 2011).

**Table 1. Teacher Semi-Structured Qualitative Interview Questions**

| Main Interview Questions (Pilot Tested) |
|---|
| Can you describe some lessons or activities that you have used in the last year, prior to COVID-19, to teach children about science using food? Remember, nutrition is a science too so be sure to think about all the science topics you teach with food. * |
| Can you list things that have helped or supported you when you have incorporated food experiences in your classroom prior to COVID-19? This can be people, places or things. * |
| Can you list some challenges you faced when incorporating food experiences in your classroom prior to COVID-19? This can be people, places, or things. * |
| In your opinion, what are some reasons you should use food experiences to teach science to preschool children? * |

Additionally, cognitive interviews will be held with at least two HS teachers who will be asked to provide feedback. Cognitive interviews are a set of techniques that allow researchers to analyze how respondents understand survey/interview questions and are considered best practice in research studies (Ryan, Gannon-Slater & Culbertson, 2012; Carbone, Campbell & Honess-Morreale, 2002) Anticipated revisions include expanding or revising response options or wording.

### Data Collector Training

Data collectors will complete training in human ethics and qualitative methods before conducting interviews with HS teachers. The 5-Step Goodell method will be used (Goodell, Stage & Cooke, 2016). This method begins with a review of basic ethical standards of research concerning human subjects. Data collectors will be trained on the topics of obtaining informed consent from participants, participant confidentiality, and the need for research data collectors to reduce any social, psychological, or physical

risk for the participants. Secondly, data collectors will review qualitative research methods and data collection procedures to familiarize themselves with the methodologies and purpose of qualitative research. During this phase, data collectors will learn note taking and summarization skills that are imperative during the interview process. Data collectors will practice keeping interviews conversational as well as responding appropriately to a variety of different types of possible interviewee responses. Next, data collectors will listen to a previously recorded interview to independently practice note taking and will be given constructive feedback. In the final two steps, the data collectors will conduct two mock telephone interviews, one with a fellow data collector within the research team acting as a participant, and the second with a local preschool teacher that falls within a similar participant population. These interviews will not be used in the data analysis; however, the interviewee feedback will be used to provide data collectors with feedback on questions and interviewing techniques. Researchers will modify the interview guide based on feedback to improve clarity and flow of the guide. During the fourth and fifth steps, data collectors will be evaluated to identify common pitfalls such as counseling, teaching, overly positive feedback, leading probes and prompts, and the tendency of the interviewer to present their own perspective (Goodell, Stage & Cooke, 2016).

**Procedure for Data Collection**

Participants will be contacted through email to participate in the brief online statewide teacher survey. Participants will be asked to provide electronic consent prior to beginning the survey (**Appendix D**). Following completion of the survey, teachers will be asked if they would like to participate in a phone interview. If the participant expresses interest, they will be contacted via email or phone to set up a convenient time for an in-depth interview.

All in-depth interviews will be conducted via telephone. During the interview, participants will be encouraged to find a quiet, secluded room where they can sit for the duration of the interview. The interviews will be collected using the Rev App call recorder using university-owned electronic devices (e.g. iPad). Recordings will then be uploaded to ECU's Pirate Drive and be password protected with only access given to the PI. This data will be transcribed verbatim into a word document for analysis by a third-party transcription company. At least one researcher will conduct random spot checks of the test along with the interview recordings to ensure accuracy of transcriptions.

The consent process will occur throughout the life of the research study. Prior to the scheduled interview, researchers will confirm completion of the survey and consent. As part of the consenting process, the participants will be informed that their relationship with their worksite, East Carolina University, NC State University, University of NC Greensboro or NC A&T State University will not be negatively affected by their decision to not participant in this research study.

Confidentiality will be maintained at all times during and after the study. Any social, psychological, or physical risk will be minimized as much as possible for all participants. Nevertheless, participants will be allowed to de-participate at any time. If a participant declines to participate before or during an interview, the interviewer will thank them and will not continue data collection with participant. Teachers partaking in individual interviews and completing the survey will be provided a $30 gift card as compensation for their time.

**Procedure for Data Analysis**

All interviews will be transcribed, de-identified and summarized. Interview questions and their responses will be analyzed by the research team. Researchers will use a phenomenological approach, a qualitative method that strives to understand the common lived experience of individuals, to guide data analysis following Moustakas's structured method for inductive data analysis (Moustakas 1994; Creswell, 2012). This method was selected for this study because multiple shared experiences of individuals have to be understood in order to make a determination of the best practices and policies relative to the phenomenon. The researchers will describe an essential, invariant structure, or essence, of the common experience by combining textural and structural descriptions of experiences of the participants (Creswell, 2013). Textural descriptions are the "what"' behind participants experiences and structural descriptions are the "how" behind the participants experience of the phenomenon in a specific context and situations (Creswell, 2013).

Researchers will follow four steps for the in-depth analysis: codes, themes, categories and narrative. At the end of the analysis, researchers hope to generate a descriptive narrative that captures the overall experience of participants with science education and food experiences in the classroom. During step 1, three independent coders will read transcribed interviews to identify shared themes and perceptions related to the topic. Coders will read all interviews multiple times to catch subtleties. Phrases

that appear to be significant will be marked by each coder and discussed until 100% consensus is met amongst coders (Creswell, 2013). A preliminary detailed coding manual will be organized to aid in continual analyses of common perceptions among data to construct clusters of meaning (Creswell, 2013). In step 2, researchers will discuss and eliminate statements that do not represent details necessary for understanding the participants' experiences. Thirdly, researchers will begin to condense the manual into overall categories, themes, and subthemes based on patters in the data. Themes will describe "what" was experienced and "how" it was experienced. The team will use caution to ensure that essential components of participants' views remain intact. Finally, categories will be compared to identify interrelationships among themes to construct the overall "essence" of teachers' experiences (Moustakas 1994, Creswell 2012) (**Figure 4**).

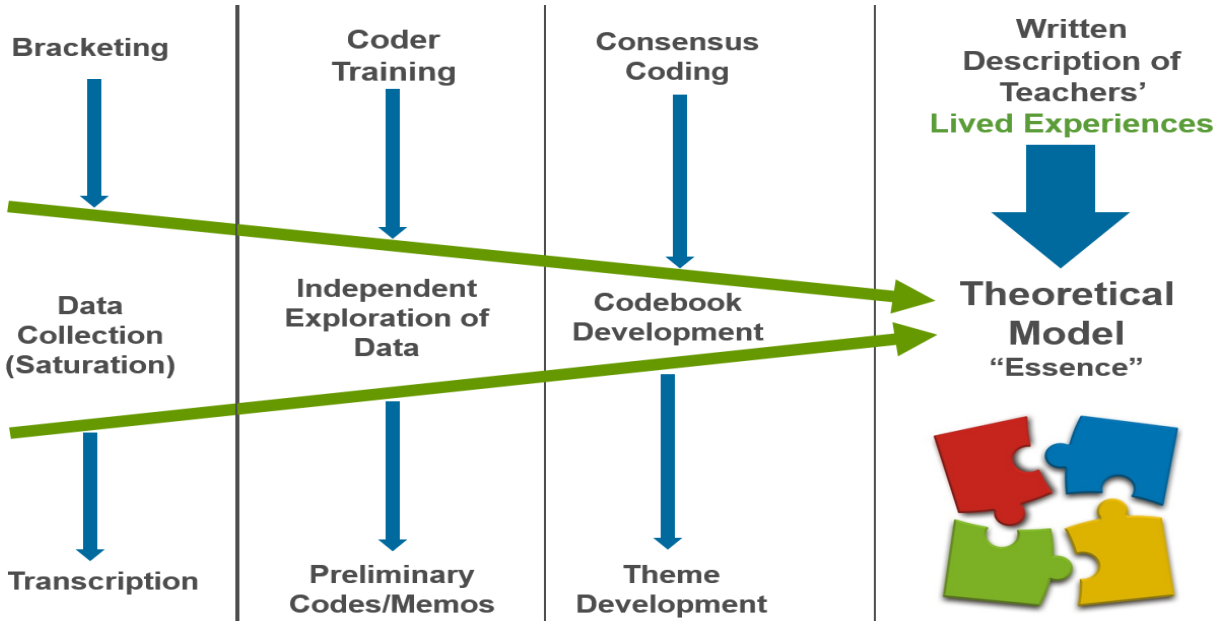


**Figure 3. Phenomenology Theory Procedures: Data Collection and Analysis**

**Validity and Reliability**

Trustworthiness in qualitative research refers to four criteria that reflect the validity and reliability of data: credibility, transferability, dependability, confirmability. Researchers will enact several techniques to address each of the four criteria of trustworthiness. To address credibility, researchers will closely review existing literature to frame methods, procedures and findings relevant to the study. Frequent debriefing sessions between researchers will identify flaws and function as a sounding board to test ideas

and interpretations. Peer scrutiny, or feedback, will be encouraged as well. Researchers will document bracketing procedures before data collection begins, a process of becoming more cognizant of personal biases about the target population and subject. Throughout the study, researchers will be encouraged to practice reflective commentary to record researcher's initial impressions of each data collection session, emerging patters or theories. This will also help researchers to become more aware of their own constructions. Lastly, triangulation will be implemented as final themes will be sent to each participating teacher for review. Teachers will be asked to review and reflect on the accuracy of the summary of their individual interview and major identified themes (Shenton, 2004). To address transferability, sufficient background data and account of the phenomenon will be provided for future comparisons' accuracy. Additional details regarding the research design, implementation, data collection and appraisal will be provided to ensure dependability, such that the study could be repeated in the future. Lastly, for confirmability, researchers will convey their assumptions and potential biases, as well as limitations of the study and their possible effect on the results.

**Potential Risks and Benefits**

There are no perceived risks pertaining to this study. Any risks that may occur with this research are no more than what the participants would experience in everyday life. However, due to the unique nature of this project, HS partners may see the responses of teachers participating in the study. To protect the identity and confidentiality of teachers and the information they share throughout the course of the study, all data shared with partners will be de-identified. Additionally, teachers could experience anxiety while being asked questions that may yield answers in non-compliance with organization, state, or federal-level priorities and/or policies. To minimize these fears, participants will be reassured that organization directors will not be informed of their participation or responses to the survey or interview. Additionally, participants will use a pseudonym to refer to themselves and any colleagues during interviews.

Teachers will receive a $30 gift card to Walmart, Target, or Amazon for participating in both the survey and interview. The results of this study will inform professional development on science education and food experiences and in turn create stronger early STEM environments to prepare children for kindergarten and beyond

## Ethical Considerations

There are no vulnerable populations for this study. An informed consent (**Appendix D**) will be provided to each participant and must be signed electronically by the participant before an interview takes place. Graduate assistants will undergo IRB training prior to engaging in any part of the study. The three trained graduate research assistants will be the ones to obtain consent from participants. HS Partners will not participate in the recruiting or consenting process to ensure undue influence and coercion is not involved during consenting. Specific responses will not be shared with anyone, including respective employers or other government agencies, nor will these parties be informed of a participant's participation or non-participation in the study. If participant divulges personal or sensitive information, it will be deleted from transcripts.

## Bias and Assumptions

Biases will be important to avoid as much as possible to ensure validity of this study's results. The interview guide and survey questions will be continually examined. Researchers will ensure that no leading questions are asked in the interview guide. The online survey and interview guide will also be edited to limit academic speech to reduce potential confusion among participants. The interview guide will revised based on feedback received from research team, experts and experiences with participants throughout the duration of the study.

## Potential Limitations

Participants volunteering for the qualitative interview may participate because they are more interested in the subject matter which could lead to bias. There are also limitations inherent in the interview process. Phenomenology, as a subjective research method, could cause participants to have difficulty expressing themselves or fabricate some or all of their responses (Alase, 2017). Another challenge will be teachers who do not provide sufficient detail to their experiences. However, purposeful probing will be used to encourage detailed responses. Additionally, researchers will be trained to remain open to teachers' perspectives by staying unbiased and nonjudgmental. Telephone interviews will limit interviewers' ability to watch the interviewee's body language in response to questions. In particular, certain questions could come off as an attempt of assessing the teacher's adherence to HS protocol. This could lead the interviewee to give manufactured answers for fear of retribution from program staff. To

address this issue, interview questions will be examined closely by the research team to remove language that an interviewee may interpret as an assessment of following protocol. Further, researches may revise wording of questions and/or clarifying meanings when needed during the interview when necessarily. Lastly, results and interpretation of the study are not generalizable to other HS.

## Expected Outcomes

Outcomes from this project will result in a better understanding of the essence of HS teachers' experiences using and integrating FBL in their classroom. Literature shows that preschool children generally consume under the daily recommended amount of FV and that the dietary behaviors children establish in the preschool years will affect long-term health status. Additionally, literature shows that foundational science learning that occurs in preschool can have long-term impacts on academic success. Since FBL has been suggested to improve FV consumption, and science learning suggested to improve kindergarten readiness, and integration of the FBL and other learning domains such as science suggested to overcome teacher barriers, this study will shed light on the what, and the how of NC HSteachers' experiences with FBL.

Expanding benefit to the local partners and the larger HS community in NC, this study aims to identify program needs, resources, and infrastructure across HS to guide the development of professional development resources that teachers can use to improve their use and integration of FBL in their classroom.

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# CHAPTER 4: CONNECTING KINDERGARTEN READINESS AND FOOD-BASED LEARNING IN THE HEAD START PRESCHOOL CLASSROOM

## Introduction

Integrative FBL is a unique opportunity for teachers to engage children in learning domains (e.g., science, mathematics, literacy) while simultaneously exposing children to healthy foods (Bayles et al., 2020; Whiteside-Mansell, Swindle & Davenport, 2019). The integration of FBL with other learning domains may be a solution to overcome frequently cited teacher barriers for FBL such as limited time and competing priorities in both primary (Follong et al., 2021) and preschool (Carraway-Stage et al., 2014; Swindle & Phelps, 2018) environments. Prior literature defines FBL as classroom-based methods to improve children's willingness to try and consume healthy foods by introducing healthy foods in the classroom (Whiteside-Mansell, Swindle & Davenport, 2019). FBL occurs through methods during the mealtime such as creating a positive mealtime environment (Dev et al., 2019), or outside the mealtime through activities such as gardening, books, and science experiments (Bayles et al., 2020; Whiteside-Mansell, Swindle & Davenport, 2019; Cooke, 2007; Sullivan & Birch, 1990).

FBL is beneficial as it allows children to be exposed to healthy foods in a less stressful environment (e.g., outside the mealtime) that encourages children's' exploration of foods using their five senses, which may not be encouraged during mealtime (Nekitsing et al., 2018; Carruth & Skinner, 2000; Orell-Valente et al., 2007). Repeated exposure to healthy foods is suggested to be the most effective method for impacting both preference and consumption (Sullivan & Birch, 1990). Impacting young children's preference and consumption for healthy foods is critical as it is estimated that 30% of preschool-aged (3-5 years) children are considered overweight or obese (Ogden et al., 2014) and less than 20% of preschool children consume the daily recommended servings of vegetables (Grimm et al., 2014). Research suggests that the habits established during the preschool years are suggested to impact long-term health status into adulthood, augmenting the importance of early FBL experiences for children (De Cosmi et al., 2017; Ventura & Worobey 2013; Harris, 2008; Birch, 1999). In addition to impacting health outcomes, FBL may also reinforce children's fine/gross motor skills (Bellows et al., 2013; Story et al., 2008) and promote learning such as literacy (Droog, Buijzen, & Valkenburg, 2014; Heath, Houston-Price, Kennedy, 2014).

Prior interventions using integrative FBL have shown promise in increasing FV consumption and academic outcomes of primary school children (Follong et al., 2021). A recent systematic review details the integration of nutrition topics within core school subjects (Follong et al., 2021). Of the 39 studies included in the review, all but one study reported improvements in children's nutrition knowledge (Follong et al., 2021). However, only two programs, the Food Math, and Science Teaching Enhancement Resource (FoodMASTER) program and the EatFit program, measured children's academic outcomes (Follong et al., 2021; Hovland et al., 2013; Roseno et al., 2015; Roseno, Duffrin & Stage, 2017; Shilts et al., 2009).

While there is literature on the integration of FBL in the primary school environment, to the authors knowledge, only two studies have integrated FBL in the preschool classroom and no studies have measured academic outcomes related to integrative FBL (Bayles et al., 2020; Whiteside-Mansell, Swindle & Davenport, 2019). The first study conducted by Bayles and colleagues engaged children in seven integrative FBL activities (e.g., science, mathematics, literacy) over 4 months in HS classrooms (2020). Outcomes of the intervention revealed children in the intervention group consumed significantly more carotenoid rich FV than the control ($F_{1,77}$=3.98; $p$=.02, r=.10). The second study explored the effects of *Together, We Inspire Smart Eating* (WISE), an 8-month nutrition education curriculum that exposed children to FV through weekly hands-on FBL activities (Whiteside Mansell, 2019). WISE provided teachers with integrative FBL activities such as learning patterns through the organization of tomatoes, spinach and cheese (e.g., mathematics) (Whiteside Mansell, Swindle & Davenport, 2019). Children in the intervention had significantly higher FV intake at post-test compared to baseline (t(263)=-.08 $p$<.039) (Whiteside Mansell, 2019). To the authors knowledge, these are the only two studies that have explored the use of integrative FBL in the preschool classroom (Bayles et al., 2020; Whiteside-Mansell, Swindle & Davenport, 2019). Without data on academic outcomes, the effect of FBL on academic knowledge such as science, mathematics and language in the preschool environment is still unclear.

The integration of FBL in the preschool environment is critical since positive FBL experiences that preschool children have in the classroom can lower risk for the development of diet-related diseases in adulthood such as obesity, hypertension, type II diabetes, cancer, and cardiovascular disease (Dietz, 1998; Raychaudhuri & Sanyal, 2012). Specifically, the integration of FBL in HS (HS), the federally funded

preschool program serving one million low-income preschools nationwide, is of concern as children from low-income families are at greater risk for diet-related diseases compared to the general population (Swindle & Phelps, 2018; Office of HS, 2016). Additionally, children from low-income families may not have access to FV in the home, limiting the number of exposures children have to healthy foods which is critical to impact preference/consumption (Gooze et al., 2012). However, children do have guaranteed access to FV while at HS via the Child and Adult Care food Program (CACFP) (Child and Adult Care Food Program, 2017). FBL's ability to impact children's FV preference and consumption is vital so that when FV are available in the HS environment, they are accepted and consumed by preschool children (Smith et al., 2019; Bayles et al., 2020).

HS previously recognized the benefits of FBL and required FBL in HS classrooms. However, the 2016 Performance Standards removed FBL as a requirement (Office of Head Start, 2016). To the authors knowledge, no studies have since explored how FBL is *currently* being implemented in the HS classroom or how FBL is currently being integrated with other learning domains in the HS classroom. Understanding the current integration of FBL in HS learning domains is key since HS's ultimate goal is to help children possess the skills, knowledge, and attitudes necessary for kindergarten readiness. Additionally, no studies have qualitatively explored FBL from a teacher's perspective. Therefore, the purpose of this phenomenological study was to explore HS teachers' experiences using FBL in the classroom. Teachers were then probed on the integration of FBL into other learning domains because of its potential to address previously cited barriers in the preschool classroom. For the purposes of this study, authors have defined FBL, or food-based sensory exploration, as the use of healthy food as a teaching tool with the intention of 1) providing repeated exposure to healthy foods for improving children's dietary behaviors; and 2) improving academic learning related to knowledge (e.g., science, mathematics, literacy) and skills (e.g., gross motor, fine, physical) in mealtime or classroom learning environments. Such experiences can be intentionally designed to introduce healthy foods to children to engage their senses while avoiding the use of food for art and food wastage.

## Methods

### Study Design

Researchers used a qualitative transcendental phenomenological approach to examine NC HS teachers' shared experiences with the use and integration of FBL with science learning activities in the preschool classroom (Moustakas, 1994; Husserl, 1999). Researchers collected qualitative data via in-depth, semi-structured interviews. Researchers chose semi-structured interviews because participants' open-ended responses can provide in-depth details of teachers' experiences using and integrating FBL in the classroom. This study was part of a larger mixed methods cross sectional study conducted across NC. The goal of the larger study was to assess specific needs, assets, and resources of partner HS programs to inform the development of teacher professional development resources for the Preschool Education in Applied Science (PEAS) Institute for Early Childhood Teachers (More PEAS Please, 2021). The Institutional Review Board at East Carolina University reviewed and approved all study protocols and materials (UMCIRB 18-002749).

**Participants and Recruitment**

Researchers identified 54 funded HS organizations in NC fall 2020. One center serving primarily migrant families was excluded since it was only open during the summer and fall months. Researchers initiated contact with education managers or program directors via phone. At times, specific programs were contacted to ensure representation by geographical location and organization size. After establishing contact, researchers provided information about the study and asked for permission to communicate with HS teachers via email. Purposive sampling was utilized such that HS teachers were asked if they were interested in scheduling an individual interview to further discuss their experiences with FBL in the classroom. A member of the research team followed up with interested teachers via email to schedule the phone interview. Of the teachers who participated in the larger study, 16% (n=35) completed a qualitative interview. Thirty-five centers never responded to the initial communication potentially because HS programs were closed or providing virtual education to children making it difficult to communicate program administrators and staff (Bauer et al., 2021). This hypothesis is supported by the fact that many HS centers follow with their public-school counterparts' calendars and many public schools were closed (Education Week, 2020).

**Data Collection**

Three trained graduate student, two female (JD and NZ) and one male (ZP), with no prior relationship to participants, conducted interviews between October 2020 and March 2021. Telephone interviews were conducted one-on-one between data collectors and participants. While the interviews occurred during the COVID-19 pandemic, teachers were asked specifically about their experiences pre-COVID-19 (Table 1). Teachers were reminded with a prompt at the start of each question to think of their experiences prior to COVID-19. At the end of the interview, teachers were given an opportunity to share their experiences considering COVID-19.

Data collection for qualitative interviews ended when saturation was reached. Saturation was defined as the point which collection of additional data yielded no new insights, themes or issues (Glaser & Strauss, 1967; Strauss & Cordbin, 1990; Bowen, 2008). Researchers verified saturation by creating a saturation grid with codes on the vertical axis and interviews conducted on the horizontal axis (Brod, Tesler & Christiansen, 2009). As interviews progressed, a visual tapering of new codes created was observed. Saturation was achieved when no new codes were developed with the collection of new interview data.

Prior to data collection, data collectors completed training in human ethics and qualitative methods using the 5-phase Goodell protocol (Goodell et al., 2016). As part of the training process, data collectors completed 2 pilot interviews using the semi-structured interview guide, first with a fellow data collector and secondly with a local preschool teacher who resembled the participant population. Pilot interviews were not used in data analysis; instead, interviewees were asked for feedback to improve data collectors interviewing techniques. Pilot interviews also served to improve clarity and flow of the interview guide (Goodell, Stage & Cooke, 2016). For example, after feedback from pilot interviews the interview guide was reorganized into two distinct sections and five interview questions were removed and/or condensed into other questions to reduce redundancy.

**Measures**

Being more conversational in nature, researchers chose semi-structured interviews to allow teachers to comfortably engage with data collectors to share their personal experiences (Peterson et al., 2017). Interviews lasted 45-60 minutes and were conducted over the phone. Researchers designed the interview guide to address primary research questions using an iterative process over multiple rounds

(Srivastava & Hopwood, 2009). The interview guide consisted of a verbal script, interview questions, and required and optional probes (**Table 1**). At the start of the interview, the interviewer informed the participant about the researcher's interest in the research topic and read the consent form to the participant to obtain verbal consent. During the interview, data collectors kept notes of participants responses to each question. At the end of the interview, the interviewer summarized the participant's response to each question and asked the participant to confirm, modify, or disconfirm their response (member checking) (Shenton, 2004). Interviews were audio-recorded using the Rev App recorder on university-owned iPads, and transcribed verbatim. In addition to detailed notes, audio-recording and member checking, other strategies employed to ensure trustworthiness included: 1) bracketing to identify researchers' potential biases prior to the start of data collection; 2) bi-weekly debriefing sessions between data collectors to discuss codes, emergent themes, and address potential biases; 3) reflective commentary; and 4) triangulation of data with HS participants (Lincoln & Guba, 1985; Bowen, 2008). Triangulation occurred by sending participants a summary of their individual interview via email which they were asked to confirm, revise, or disconfirm (Shenton, 2004). All teachers responded to the request. Interviews continued until saturation was achieved, or the collection of new data did not yield novel information about the phenomenon being studied (Bowen, 2008; Creswell, 2012).

**Table 2. Teacher Semi-Structured Qualitative Interview Questions, Including Probes (n=35)**

| Interview Questions (Pilot Tested) | Required Probes |
|---|---|
| Can you describe some lessons or activities that you have used in the last year, <u>prior to COVID-19,</u> to teach children about science using food? Remember, nutrition is a science too so be sure to think about all the science topics you teach with food. | a. <u>If activity described appears to be preplanned ask:</u> Can you give me an example of a time you use food as a teaching tool that was not preplanned?<br><br><u>If activity appears to be unplanned ask:</u> Can you give me an example of a time you used food as a teaching tool that was planned?<br><br>b. What are some things that have influenced your ability to use food experiences as a teaching tool in the classroom?<br><br>c. How did you know when you were doing a good job of **<u>incorporating</u>** food experiences?<br><br>d. How did you know when you were **<u>struggling</u>** to do a good job incorporating food experiences?<br><br>e. How did your standard of determining if you were doing a good job or struggling compare to what your supervisor expected of you? |

| | |
|---|---|
| Can you list things that have helped or supported you when you have incorporated food experiences in your classroom prior to COVID-19? This can be people, places or things. | a. I heard you list **[say what they listed as supports]** are there any others you would like to add?<br><br>b. Which of these supports you've listed do you think helped the most?<br><br>c. How did having this help or support influence which activities or lessons you did in the classroom?<br><br>d. Can you give me a detailed example, like a story, about how **[list what they said was most helpful]** has helped incorporate food experiences in your classroom prior to COVID-19? |
| Can you list some challenges you faced when incorporating food experiences in your classroom prior to COVID-19? This can be people, places, or things. | a. I heard you list **[say what they listed as challenges]**, are there any others you would like to add?<br><br>b. Which of these challenges you've listed do you think is the biggest?<br><br>c. How did this challenge affect which science activities and lessons you did in the classroom prior to COVID-19?<br><br>d. Can you give me a detailed example, like a story, about how **[list what they said was most challenging]** has been a challenge for you while you incorporated food experiences with children prior to COVID-19? |
| In your opinion, what are some reasons you should use food experiences to teach science to preschool children? | a. On the contrary, what do you think are some reasons you should not incorporate food experiences to teach science to preschool children? |
| In what ways has COVID-19 already impacted your current science classroom? | a. How might COVID-19 impact your use of food experiences?<br><br>b. How else might COVID-19 impact your classroom as a whole? |

**Data Analysis**

Researchers used Moustakas's structured method for inductive data analysis in this phenomenological study (Moustakas 1994; Creswell, 2012). Researchers followed four steps for the in-depth analysis: 1) Horizontalization; 2) Reduction of Statements; 3) Categorizing or "Clustering"; and 4) Final Identification and Narrative of Themes. The study's first author (JD) and a second analyst (NZ), who were trained in coding, served as the primary coders (Goodell et al., 2016). Prior to analysis, coders immersed themselves in the data by reading all manuscripts twice. Coders re-read transcripts a third time to record preliminary memos and highlight key concepts (Moustakas, 1994). Coders then began the first step of analysis, horizontalization, by independently reading transcripts, giving equal value and importance to each statement, and coding statements with a descriptive label (Moustakas, 1994). In step 2, coders eliminated statements that were not a horizon of the experience being studied and therefore did

not represent details necessary for understanding the participants' experiences. Research meetings occurred 3 times weekly between the coders. At each meeting, coders collectively read each transcript comparing codes until 100% verbal consensus was met (Creswell, 2013). When necessary, a third author (VS) served as a tie breaker. Coders organized a preliminary coding manual where codes were identified and defined to aid in analyses of common perceptions among data to construct clusters of meaning (Creswell, 2013). Additionally, throughout the analysis process, coders maintained memos which consisted of emergent codes, categories, theoretical connections, themes, and theoretical questions (Creswell, 2013; Saldaña, 2009) which were also discussed during research meetings. Memos served as documentation of how coding evolved throughout the analysis (Saldaña, 2009). Thirdly, researchers condensed codes into overall categories or "clusters" and assigned each category a thematic label. This step was repeated to collapse all codes into subsequent categories. Lastly, coders derived final themes from the data and confirmed themes by rereading transcripts to ensure that themes and codes were consistent with teachers' expressed words. Final themes described the "what" (textural descriptions) and "how" (structural descriptions) of participants' experiences, which together represent the overall essence of the phenomenon (Creswell, 2013; Moustakas 1994, Creswell 2012).

## Results

A total of 35 teachers from 16 counties spanning each geographical region of NC (Mountains, Piedmont, and Coastal Plain) were included in the final sample (**Figure 1**). Participants were 94% female and were an average age of 40.8 $\pm$ 10.06 years at the time of the interview. Teachers' races were predominantly White (52.9%) and Black/African American (44.1%). Teachers' ethnicities were predominantly non-Hispanic (97.1%) followed by Hispanic (2.9%). Many teachers held a bachelor's degree (54.2%), 8.6% of teachers had completed a master's degree, 20% had an associate degree, and 5.7% had taken some college courses. Most teachers (82.9%) had experience working in other preschool settings outside of HS.

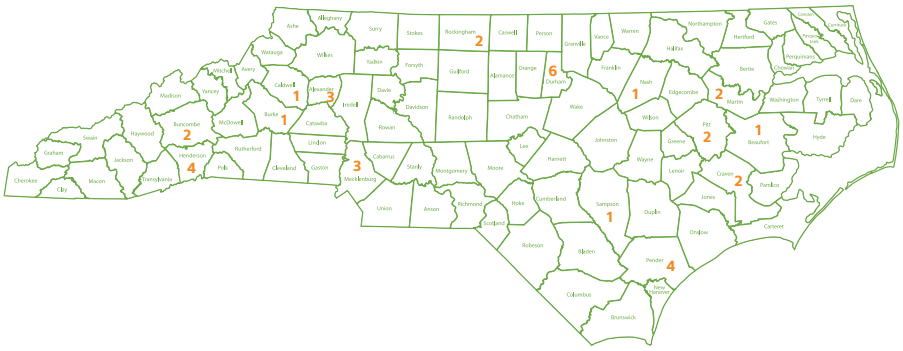

**Figure 4. Teachers from North Carolina Counties Participating in Semi-Structured Qualitative Interviews (n=35)**

Researchers identified eleven primary themes related to teachers' experiences using and integrating FBL experiences in the classroom (**Table 2**). To better understand the complex system affecting teachers' use of FBL and integration of FBL in the classroom, researchers inductively organized themes and subthemes using the Systems Thinking Iceberg Model (Anderson & Johnson, 1997; De Savigny et al., 2009; Carey et al., 2015). The Model identifies four interacting components of a system: 1) Events (What just happened?); 2) Patterns/Trends (What trends have there been over time?); 3) Underlying Structures (What has influenced patterns? What are the relationships between the parts?); and 4) Mental Models (What assumptions, beliefs, and values do people hold about the system? What beliefs keep the system in place?). **Figure 5** visually represents the identified themes within the theoretical model.


**Figure 5. Theoretical model presenting relationship between HS teachers' (n = 35) experiences with FBL at 4 different levels**

### Level 1: FBL Events in the Preschool Classroom

Teachers described two main events (Level 1) where FBL occurs in the classroom: inside the mealtime and outside the mealtime. Many teachers struggled to envision the possibilities of FBL outside the mealtime environment leading to most FBL events occurring at mealtime. Teachers who did FBL outside the mealtime often struggled to relate FBL to academic concepts.

#### *FBL inside the mealtime environment*

Teachers described the contexts in which they integrated FBL in the classroom, both inside and outside the mealtime environment. However, many teachers reported that the mealtime was the primary location for FBL activities. Teachers described that they used FBL during mealtime to teach children about nutrition concepts (e.g., food groups, healthy versus unhealthy foods). A few teachers stated that FBL occurred exclusively in the mealtime environment: "I would say food conversation and experimentation is limited to lunch in investigative conversation while they're eating" (Tammy). Teachers listed a plethora of FBL strategies they used during mealtime such as encouraging children to try foods before stating they did not like them (e.g., no thank you bite*)*, using positive descriptive words to talk

about food (e.g., “these peas are so green and fresh”), providing children with physical and verbal rewards, encouraging children to make a “happy plate” (e.g., trying everything on their plate at least once), and role modeling healthy eating behaviors. Teachers’ activities and strategies were primarily focused on getting children to eat food at meals, rather than exploring food through integrative learning outside of meals.

***FBL outside the mealtime environment***

Conversely, some teachers described using food outside of mealtime as a tool for integrative learning with other learning domains, such as science or math. When considering FBL’s role in science, many teachers discussed using healthy food to demonstrate common preschool science concepts (e.g., lifecycle, hibernation, vehicles). However, the food featured in these activities were often disconnected from the science concept being explored. For example, teachers described using food as art or construction material to illustrate a scientific concept, rather than utilizing food as the scientific concept be studied. For example, Leah describes a unit about the lifecycle of a butterfly:

> Nutrition is taught alongside with science…One example in specific would be, we were discussing the life cycle of the butterfly… So we used food, healthy food, such as celery, tomatoes, raisins, and created a butterfly out of those vegetables. Then we also create a flower using vegetable two weeks later, and then discussing how the flower grew and how the butterfly drank from the flower, so that’s kind of how we incorporated food with our science lesson. (Leah)

Few teachers recognized that there was a weak connection between the FBL activity they were describing (e.g., making a butterfly out of celery) and the science concept (e.g., lifecycle of a butterfly); however, most teachers believed that the FBL activity was beneficial for improving children’s science knowledge. While many teachers recognized that FBL and science could be taught in tandem, teachers struggled to utilize FBL as a scientific concept (e.g., studying celery as an example of a vegetable plant that butterflies help pollinate) and rather used food as part of their science “themes”, a common practice in the preschool classroom, or art (e.g., making butterfly out of celery).

**Level 2: Patterns and Trends of FBL in the Preschool Classroom**

Teachers’ detailed descriptions of FBL events revealed overarching patterns (Level 2) that define FBL in the classroom including teachers use of unhealthy foods in FBL activities, teachers’ uncertainty on how to integrate FBL into other learning domains (e.g., mathematics, science, literacy) and teachers’

general feelings of helplessness related to doing FBL in the classroom. These patterns hindered teachers' ability to implement FBL and/or made FBL less beneficial for children.

***Teachers' use of unhealthy foods in FBL activities outside the mealtime environment***

Teachers frequently described FBL activities that used unhealthy foods (e.g., M&Ms, cool whip, crackers). Many teachers indicated that they enjoyed doing taste tests in their classroom to expose children to new food. During these activities, children were often encouraged to try a variety of foods and discuss their preferences.

> We had pure pumpkin, had pumpkin puree, pumpkin-flavored donuts, different pumpkin things, to expose them to things that they might not really be exposed to at home. I don't really know any child that goes and eats pumpkin. (Mia)

Other teachers created their own FBL activities after discussing nutrition-related topics. For example, after a discussion on the benefits of protein, Tammy explains "we do push-ups and then we eat a piece of pepperoni and then we do more pushups and see if we're stronger." Many teachers, however, did not consider these foods (e.g., donuts, pepperoni) to be unhealthy and stated that they were required to only use healthy foods in HS.

***Uncertainty on how to integrate FBL into other learning domains***

Teachers indicated that they were unsure how to integrate FBL with other subjects (e.g., science, math, literacy) in the classroom. Teachers more often viewed food solely in the context of mealtime and did not see how food could be integrated into other learning domains. One teacher explicitly stated that she knew, in theory, that FBL could be integrated, however, she didn't know how to do it:

> They're all exposed to food in our classroom, and you can use food to teach so many things, like language, literacy, math, cultural diversity, different foods. [But] aside from just talking about where food comes from and what it does for our bodies, I'm not really sure how to make that into an activity aside from like our fruit salad… I don't really know how to incorporate food into a science lesson. (Nicole)

After explaining that they were unsure how to integrate FBL into other learning domains, teachers repeatedly cited that they would like future training to learn how to integrate FBL with other learning domains to reduce the uncertainty that they feel.

***Feelings of helplessness related to FBL in the classroom***

A common trend in teachers' perception of FBL in the classroom was feelings of helplessness. Teachers stated that it is difficult to encourage children to try foods during FBL activities, with many

teachers stating there was nothing they could do to change a child's decision not to try a food: "There's still some things that no kid's going to like no matter what but through our actions we try to tell them that's good…. No matter if they like making it or playing with it, they still won't even attempt to taste it, even with the tip of their tongue or anything" (Teri). Teachers expressed children were stuck in their preferences and were not likely to change their minds about certain foods, regardless of how many times teachers included the food in FBL activities: "he's not going to try [the new food]. So, it could affect all over, not just one time, but every time you try to do something in that aspect" (Susie). Other teachers emphasized the importance of honoring children's preferences about food, such that if a child expresses that they do not like a certain food, they should not be asked to try it again later. The idea of honoring children's preferences extended into FBL activities where teachers stated they purposefully chose foods for FBL activities that they knew children would like (e.g., fruits), and avoided foods (e.g., vegetables) that they knew children would not be likely eat.

**Level 3: Underlying Structures Affecting FBL**

Teachers struggled with several underlying structures (Level 3) that influenced the patterns of teachers' use and integration of FBL in the classroom. These underlying structures often presented themselves as barriers to FBL in the classroom and included food waste, policy, and more recently, the impact of COVID-19 on FBL.

***Food waste***

Teachers were concerned that FBL activities that involved children "playing" with food were detrimental since teachers perceived food that was played with could not be consumed by children. Many teachers emphasized that some of the children in their classroom came from food insecure homes and manipulating food in ways that it could no longer be consumed was inappropriate. Some teachers cited food waste as a primary reason they did not do FBL in their classroom: "No, we're not allowed to use food… if we use food that that could have been food that they could have ate. So, we don't actually get to use any chemistry to teach our children science (using food)" (Lucy).

***Policy environment***

The HS FBL policy environment was also a major underlying structure affecting FBL. Teachers commented that they received contradictory communication from coworkers and administrators about policies regarding FBL:

> So, the first year (the supervisor) was discouraged from using food and I heard from other co-workers that we weren't supposed to use food in our classroom ever, at all, for any reason. And I had to probe and push and ask, and then, communication came out oh no, their policy does allow it. (Natasha)

This contradictory communication was further exemplified in two separate interviews where two teachers described the same activity (e.g., making a necklace out of cheerios to practice counting) with one teacher stating the activity was a *positive* example of a FBL activity and the other stating it was a *negative* example because of policies related to FBL. Many teachers interpreted their center's policies to not support FBL outside of the mealtime environment.

Related to policy, teachers also had concerns about the safety of FBL experiences in their classroom stating that both sanitation and food allergies were concerns. Teachers interpreted HS sanitation policy to indicate that the sharing of utensils and children working together were not allowed. Many teachers also mentioned concerns about children's allergies and being cautious not to bring in any common food allergens.

***COVID-19***

Lastly, teachers described barriers to FBL considering COVID-19. Teachers highlighted that COVID-19 has further limited, or removed, their ability to integrate FBL in the classroom. One teacher described FBL during COVID-19 as a "taboo" subject stating that "[after COVID hit, they [administration] don't want us bringing in any kind of anything that children might touch. So, [FBL] has become very taboo" (Alex). Teachers commented that center- and class-wide changes related to COVID-19 (e.g., social distancing, smaller classroom sizes, masks, no outside visitors) have counteracted open exploration, like FBL, in the classroom. Teachers expressed concerns about the up-and-down attendance of children during COVID-19 which has "thrown everyone's rhythm off" and prevented children from establishing a sense of normalcy within the classroom. During time periods of remote learning, teachers expressed further concern about FBL stating that it is not feasible to assume parents have materials at home to do FBL: "We could talk about food, but we don't do any type of experiments or anything,

because we just don't want to offend anybody by asking, "Do you (parents/children) have this in your home or can you go out and get this" (Sean).

**Level 4: Teachers' Mental Models for FBL**

Teachers expressed their beliefs and values about FBL by describing what motivates them to do FBL, how they perceive themselves to be successful at FBL and how FBL fits into their overall goals as teachers. According to the Systems Thinking Iceberg Model, the mental models that teachers have created for FBL keep the current system of FBL in place (Level 4) (Anderson & Johnson, 1997; De Savigny et al., 2009; Carey et al., 2015).

***Motivators for FBL***

All teachers believed that FBL had value for the children in their classroom. Teachers were motivated to include integrative FBL experiences in their classroom due to the social, cultural and health benefits of integrative FBL.

Socially, teachers believed that FBL created connection for children. Many teachers felt that FBL was a beneficial topic because "all kids eat". Teachers expressed that food is an object that connects children's home and school lives. Sally explains, "it's daily life… whether they're at school or at home at a restaurant, they're able to make connections with." Teachers perceived that this unifying characteristic of food, enabled FBL to help children build relationships and social skills with teachers, peers, and families. Alex believed that FBL, specifically cooking, created powerful bonds between children and caregivers: "I think it's really important to teach children in the scope of relationships…cooking naturally has that relationship aspect to it."

Teachers were also motivated to include integrative FBL experiences, like cooking, in the classroom because of its benefits in improving children's cultural awareness. Teachers explained children may be unaware that different families prepare and eat different foods. FBL can facilitate children in the process of learning about and appreciating differences among their peers. Teri referenced an instance when "(One child) had hummus. It smelled different than what they were possibly used to. We used that as a tool to say they eat some different foods that maybe you haven't been exposed to". Teachers also invited children's parents to come into the classroom and prepare a traditional dish from their culture to share with the children: "We have a staff person in our program that's Hmong so we had her to come into

our classroom, and show us how to make fried rice in the authentic way, and then let the children taste test it" (Lily).

Teachers also reported being motivated to integrate FBL because of its ability to improve children's health. Many teachers commented that FBL increased children's' familiarity with healthy foods. Some teachers emphasized that children may not have had exposure to these foods outside of the program so FBL served as an avenue to expose children to new healthy foods: "Once you bring in foods that children maybe have never seen before, to let them try something that they've never even heard of" (Valerie).

Teachers considered FBL as beneficial for impacting the long-term health of children. Teachers expressed concern about childhood obesity and sedentary behaviors of children and stated that this reinforced the necessity of FBL: "We think about the children that I teach are from low-income families. So, one of the things we really talk to them about is nutrition and exercise, so that we don't have childhood obesity, things like that" (Tasha). Most teachers felt personally responsible for ensuring children grew up to be healthy and emphasized that the knowledge and experiences children gained from their classroom could positively impact their future lives.

Teachers believed that the exposing children have to healthy foods during FBL in their classroom could not only impact children's health, but the health of their families as well. In this sense, teachers felt children could act as agents of change by advocating to their parents for the provision of healthier foods. One teacher explained, "(say there is) something that we present to the class, like say, Brussels sprouts or raw broccoli, that, 'Maybe I didn't get this at home', and I can introduce that and let my mom know, 'Hey, I like this.' 'Okay, well, I'll continue to buy this for you" (Aaliyah).

***Perceptions of successful FBL***

Teachers believed they were successful at FBL through various indicators, the strongest of which was whether children consumed the presented food(s). Teachers stated they were successful at FBL when children consumed the food: [I know I'm doing a good job] when they're stuffing food in their mouth" (Mia). Some teachers expressed having an active role in helping children try foods presented by using strategies (e.g., no thank you bite) to encourage children to try the food. While many teachers defined their FBL success by children's willingness to eat the food, teachers simultaneously expressed feelings of

helplessness in getting children to try foods due to preschoolers' unwillingness/hesitancy to try new foods (neophobia). In some cases, teachers described children may be familiar with a food, but did not want to try it when presented in a new form (e.g., raw versus cooked) and emphasized the unpredictable nature of their preferences (e.g., will eat carrots one day but not the next).

Other less frequent perceptions of success were children being engaged in the FBL activity, children facilitating conversations with their parent about the activity, and children retaining or expanding on information from the activity. Children were engaged in an activity if they were paying attention (e.g., not being disruptive) and asking questions. Teachers also emphasized that they felt successful if children told their parents about the FBL activity during pick-up. Lastly, teachers indicated that they perceived themselves to be successful if children retained or expanded on the content of a FBL activity. For example, Mia stated, "Not only are they eating it, but they're talking about it. They're making that connection when they go into housekeeping, like 'Hey, we tried oranges today. Here's an orange'".

***Kindergarten readiness***

Teachers stressed the importance of preparing children for kindergarten, which is one of HS's primary goals. Many teachers made a connection between the science learning environment and preparing children for kindergarten. Teachers commented that science naturally lent itself to teaching children concepts in literacy, math, and fine/gross motor skills. One teacher stated,

> I think with preschool science and education it would go back to what those developmental milestones are for that age, so of course they're going to be working on their language and they're going to be working on their fine motor skills, they're going to be working on their gross motor skills and all those things can be incorporated. (Lily)

However, few teachers made a connection between integrative FBL and kindergarten readiness. One teacher mentioned that integrative FBL could help children learn math concepts, such as measuring: "I think it's wonderful to teach food experiences in the classroom, because children are learning about measurement. They're learning about food groups and food items. They're learning about the colors of the food" (Tasha).

However, most of the time, the benefits of FBL were more frequently associated with the mealtime environment and health outcomes such as consuming more FV or growing up healthy. Although teachers expressed that FBL was beneficial, the connection between FBL and preparing children from kindergarten was minimal. Teachers expressed that they desire to prepare children for kindergarten, but

they did not see how FBL could help them achieve that goal. Teachers detailed other valuable characteristics of FBL that made them want to do FBL in their classroom, but very few of the benefits teachers mentioned were academic-related.

**Table 3. Supportive HS Teacher Quotations for Themes Aligned with the Systems Thinking Iceberg Model (n = 35)**

| Theoretical Category | Theme | Example Quotes |
|---|---|---|
| FBL Events in the Preschool Classroom | Inside Mealtime Environment | "That could definitely be maybe what we're having on the lunch menu for that day, that, "Oh, well, we wasn't talking about... It's a vegetable, but this wasn't the vegetable that we're talking about. Let's all see who liked that, who doesn't like it." We can make a chart and count. We can actually talk about if it's crunchy, if it's soft, if it's sweet, was it sour. It all goes back to those five senses too. So it kind of builds up off each other." (Blue) |
| | Outside Mealtime Environment | "I guess what we do with food is more honestly artistic. We will make a fire truck out of a Graham Cracker and licorice and carrots. So that would be more food as art. I don't know, as we do food as science necessarily other than growing sunflower seeds, beans, avocado." (Tammy) |
| Patterns and Trends of FBL in the Preschool Classroom | Teachers Use of Unhealthy Foods | "We were making worms in the dirt, because we were talking about insects and so the item included pudding, and gummy worms and Oreo cookies, so that we tend to have our model, so that the children can understand that there are layers, and that the worms go in and out of those layers to get where they need to. So my co-worker purchased most of the materials that we needed in order to do the activity with the children so they were able to see and taste all the goodness." (Lily) |
| | Uncertainty on How to Integrate FBL into Other Learning Domains | "[I would like] new ideas on how to incorporate food with science. I feel like I have simple, simple ideas, but some that will create higher thinking and higher learning." (Simone) |
| | Feelings of Helplessness | "Just if they don't like it. I mean, but there's not much I can really change about someone's sense of taste." (Mia) |
| Underlying Structures Affecting FBL | Food Waste | "If you're going to throw it away, then no. Because that child might not have anything to hold it and to eat and I'm playing with the rice or I'm doing something and I'm throwing it away. So, other than that, you should teach him about science not with food, but only if they are allowed to eat it or grow it, but not to throw it away." (Melissa) |

| | | |
|---|---|---|
| | Policy | “I think that the biggest challenge is the limitations that the state has put on us. As far as I know, it's the state. It's been the same no matter where I go. And I know some places are stricter than others. Because the state says you can't have food in it's edible form in the classroom. But where I'm at now, they're a lot stricter even than that, you can't really have it at all. So I have to say that that's the biggest setback. Because if we were allowed to have it in the classroom, then I think teachers would be encouraged to find ways to adapt to where they could use it for the children, and make the germ thing work. If we could at least have it in the classroom, then we'd have the opportunity to try to see if we could work around the germ issue. But we can't even have it in the classroom, so that's definitely the biggest.” (Alex) |
| | COVID-19 | “Well, we're not allowed to do them right now. I'm going to get by with the one that we're doing on Friday because I'm just going to shut my classroom door I guess. The kids will wear gloves and they each have their own measuring spoon but that's just not something that I guess that we can do all the time. They don't really want us doing a lot of nutrition activity.” (Ashley) |
| Teachers’ Mental Models for FBL | Motivators for FBL | “I think that's important because I think the more they know about food as they get older, the more they can make their own choices on food. Like I said, it introduces them to new foods. Who knows? That might start somebody on a journey to healthy eating, if they're familiar with foods from when they're young.” (Sean) |
| | Perceptions of Successful FBL | “When the kids were willing to try something that they've never tried before, maybe. If we can convince them along the way that this is something that we should at least try before we say we don't like it, makes us think that we're working our way into a good direction… (but) sometimes it's hard just because kids are kids and they like what they think they like and that's it.” (Teri) |
| | Kindergarten Readiness | “I think that it's (science) a huge skill that kids need to know. Science is a lot of what our world is coming to, like the medical field and technology, all of that is based in science, and science really builds the critical thinking skills, which are important in any field of work that they go into, and even just going into kindergarten and elementary school, just building those critical thinking skills. I also think that it teaches them about the world around them, which, as a small kiddo, it can feel like the world's really big and very confusing. I think when you use science with them and they're able to understand some of the world around them, it gives them a sense of safety that they may not have.” (Nicole) |

## DISCUSSION

This phenomenological study explored HS teachers use and integration of FBL with other learning domains in the preschool classroom. Exploration with teachers revealed a complex system impacting FBL in the classroom. Eleven primary themes emerged from this research and were categorized within the four levels of the Systems Thinking Iceberg Model (Anderson & Johnson, 1997; De Savigny et al., 2009; Carey et al., 2015). Study findings provide unique in-depth insight into teachers’ experiences and perceptions of FBL as acknowledged by teachers themselves.

In the current study, teachers utilized evidence-based, positive feeding practices during mealtime (e.g., role modeling, descriptive words) (Dev et al., 2016; Dev et al., 2019, Hendy & Raudenbush, 2000). While teachers' positive feeding practices are praiseworthy, it is concerning that many teachers did not utilize FBL outside the mealtime environment. Prior research suggests that exposing children to FBL outside of the mealtime environment has the potential to allow children to freely explore healthy foods with all five senses without the added expectation of consuming the food or distracting children from practicing self-regulation (Carruth & Skinner, 2000; Orrell-Valente et al., 2007). FBL outside the mealtime environment has also been suggested to improve liking and consumption of healthy foods in children (Dazeley & Houston-Price, 2015; Hoppu et al., 2015; Johnson et al., 2007; Sullivan & Birch, 1990) and may impact kindergarten-readiness outcomes like science, math, and literacy (Carraway-Stage et al., 2014; Swindle & Phelps, 2018).

Additionally, expanding teachers' mental model around FBL beyond the mealtime may positively impact teachers' inherent beliefs and values about FBL. Presently, teachers assumed that to be successful at FBL children must eat the food presented during an activity. This often causes teachers to experience feelings of helplessness during FBL activities when children consistently reject foods (Stage et al., 2020; Mita, Li & Goodell, 2013). As nutrition professionals, we recognize that rejection of food is not uncommon as children's neophobia, or "fear of the new", is heightened during the preschool years (Dovey et al., 2008). However, many preschool teachers may not be aware of these expected biological behaviors and respond in frustration and implement detrimental practices such as forcing children to eat or offering fewer exposures to healthy foods (Galloway et al., 2005; Kaar, Buti & Johnson, 2014; Gregory, Paxton & Brozovic, 2011). If HS teachers continue to assume that their FBL success depends on whether a child eats the presented food, FBL may become an increasingly defeating endeavor in the preschool classroom. Assisting teachers to redefine their perception of FBL success to instead be focused on using healthy food to impact academic outcomes with the additional bonus of exposing children to healthy foods may positively impact teachers' personal attitude towards FBL (Whiteside-Mansell, Swindle & Davenport, 2019). Helping teachers redefine these beliefs of FBL is critical because prior research suggests that perception itself is an important determinant in teachers' commitment to continue to deliver nutrition education in the classroom (Hall et al., 2016). For example, if teachers' perspective of FBL success

shifted from "*I need to get this child to eat this broccoli so that he will have eaten some vegetables*" to "*I need to encourage this child to explore this broccoli using his sense of sight and touch so he can learn about the science of broccoli's plant parts (root, stem, leaf)*", teachers would be set up for success, rather than failure. Helping teachers redefine their success in terms that are achievable is important as prior research suggests that teachers are motivated by their ability to 'make a difference' in children's lives (Stage et al., 2020; Sisson et al., 2017). If teachers feel empowered in their ability to make an impact on children's academic outcomes through FBL, it is likely teachers will want to continue in their efforts.

Teachers were ultimately unsure how to integrate FBL into other learning domains and fail to make a connection between integrative FBL and its ability to impact kindergarten readiness. The FBL activities that teachers considered to be integrative often did not address learning domains such as science or mathematics, and instead used food as art, such as building a butterfly out of celery and tomatoes). For this study, researchers defined FBL as the use of healthy food as a teaching tool by 1) providing repeated exposure to healthy foods for improving children's dietary behaviors; and 2) improving academic learning related to knowledge (e.g., science, mathematics, literacy) and skills (e.g., gross motor, fine, physical). While the activity of making a butterfly model out of celery exposes children to healthy foods, it does not improve children's academic learning about butterflies. While it is well established in prior literature that FBL and exposure to healthy food in the preschool environment can improve long-term healthy eating, the lack of connection between FBL and academic learning in the preschool classroom is concerning since teachers may consider nutrition/exposing children to healthy foods a low priority compared to preparing children for kindergarten (Carraway-Stage et al., 2014). Prior FBL interventions, such as WISE, show promise that FBL can successfully be integrated into preschool learning domains necessary for kindergarten readiness. For example, in one WISE lesson children are taught the mathematical concept of patterns by having children create spinach, tomato, and cheese kabobs using patterns (personal communication, March 25, 2022). Highlighting the promise of FBL to address kindergarten readiness goals is critical to help teachers make the connection between FBL and kindergarten readiness while also appealing to teachers' preexisting priorities (e.g., kindergarten readiness) and increasing teacher-buy-in (Carraway-Stage et al., 2014).

While impacting events at the “surface level” (e.g., teach teachers how to do FBL outside the mealtime environment) is important, the Systems Thinking Iceberg Model proposes that individuals must also work to change the *overall* system to enact systemic change (Tochim et al., 2006; Atwood et al., 2003; De Savigny et al., 2009; Hawe, Shiell & Riley, 2009). To do this,multi-level collaborations amongst researchers, nutrition educators, policymakers, and HS administrators should be focused “beneath the surface” at changing the underlying structures and inherent mental models of teachers towards FBL. For example, in the current study, teachers held the mental model that preparing children for kindergarten is important, but teachers did not hold the belief that FBL can help them reach that goal. Teachers’ belief that FBL is unrelated to kindergarten readiness is unsurprising as many nutrition interventions do not discuss academic benefits and solely emphasize health outcomes as primary goals. While the correlation between a healthy diet and improved academic success are not novel (Anderson et al., 2019; Rampersaud et al., 2005; Florence, Asbridge & Veugelers, 2008), nutrition professionals should consider if too much emphasis is currently placed on highlighting the health benefits of FBL and too little emphasis is placed on highlighting FBL’s academic benefits related to kindergarten readiness. Helping teachers make the connection between FBL and preparing children for kindergarten may increase teacher buy-in to see FBL as a classroom practice that *supports* rather than *deters* from their goals.

**Limitations**

Although teachers interviewed were from a large geographic span of the state, due to the qualitative nature of the study, findings are not generalizable outside the NC HS teachers represented in the study. Teachers in this study were also mostly female and primarily White or Black/African American, limiting the gender and ethnic diversity of the findings. However, participants in this study are similar to the national demographics of HS teachers who are 56.30% White and 35.14% Black (Office of HS, 2021). Additionally, researchers utilized a purposive convenience sample which may have influenced findings. Teachers who were more interested in the topics of FBL or science education may have been more likely to participate and may have different perceptions on this topic compared to those who chose not to participate. Nevertheless, convenience sampling is considered best practice when working with community partners (Draper, 2010; Green & Thorogood, 2004). Additionally, telephone interviews were utilized in the present study which prohibited researchers from evaluating participants’ nonverbal cues as

well as increasing the difficulty of establish rapport with participants (Irvine, Drew & Sainsbury, 2013; Novick, 2008). Nevertheless, telephone interviews have been cited as beneficial when sampling teachers across large geographic areas, and to the authors knowledge, there has not been evidence that telephone interviews diminish the quality of qualitative data (Novick, 2008) and have been identified as an ideal medium to conduct semi-structured qualitative interviews (Cachia & Millward, 2011). Social desirability bias may also have impacted study findings as participants may have responded in ways that made their classroom practices appear more favorable or unfavorable; however, researchers used strategies to limit this effect such as introducing the study, establishing rapport, and asking follow-up questions (Bergen et al., 2020).

## CONCLUSIONS AND IMPLICATIONS

To the author's knowledge, it is one of the first studies to qualitatively explore teachers' experiences with FBL in the preschool classroom. Understanding how teachers perceive FBL in their role as a teacher is critical for changing the overall system to be more supportive of FBL and align with teachers' goals and values.

Integrating FBL into learning domains in the HS environment may present a unique opportunity to improve preschoolers' exposure to healthy foods while preparing children for kindergarten. Prior studies in preschool populations indicate that FBL can be integrated into kindergarten readiness outcomes (e.g., science, mathematics, literacy) (Swindle & Phelps, 2018; Bayles et al., 2020). Further, prior studies in K-12 populations indicate that FBL can impact academic outcomes (Follong et al., 2021; Hovland et al., 2013; Roseno et al., 2015; Roseno, Duffrin & Stage, 2017; Shilts et al., 2009). However, additional research is warranted to investigate the potential impact of FBL on academic outcomes in preschool populations since, to the author's knowledge, all prior interventions in the preschool setting have only assessed dietary outcomes (Whiteside Mansell, Swindle & Davenport, 2019; Bayles et al., 2020).

Teacher professional development programs within HS programs may be an opportunity to impact all 4 levels of the Systems Thinking Model. Professional development at level 1 ("events") should be focused on expanding teachers' perceptions of FBL outside the confines of the mealtime by teaching teachers how to integrate FBL into academic learning domains. Newly developed professional development may support shortcomings of previous trainings by comprehensively addressing teachers'

personal experiences and beliefs of correct behaviors and practices to change unhealthy patterns related to FBL in the classroom (Swindle, Patterson & Boden, 2017).

Secondly, efforts to impact teachers' beliefs, values, and mental models related to FBL are needed. Dialogue with teachers about FBL should emphasize FBL's potential to prepare children for kindergarten, which is also supportive of teachers' personal goals of ensuring children are ready for kindergarten.

Lastly, future interventions should focus on impacting underlying structures, such as the policy environment, that hinder teachers' ability to do FBL in the classroom. Prior research supports the findings of the present study that policy confusion is a significant barrier to FBL (Peterson et al., 2017). In 2016, HS removed all policies on FBL (Office of HS, 2016). The lack of direction at the federal level has caused widespread uncertainty at the local level as to what is acceptable for FBL in the classroom (Carraway-Stage et al., 2014; Kaphingst & Story 2009; Peterson et al., 2017). In one instance, state sanitation policies regarding FBL cooking activities were misinterpreted by local centers to prohibit any cooking activities. Other federal HS policies like "no outside food", intended to prohibit unhealthy food from entering the classroom, have been interpreted at the local level to prohibit all food, inhibiting FBL such as taste testing healthy foods. These misinterpretations have historically caused lower teacher efficacy, and infrequent FBL, hindering teachers' ability to have an impact on children's long-term dietary quality (Peterson et al., 2017). Consolidation of policies and clear communication to teachers from both the federal and local level is essential to promote a positive learning environment where teachers feel supported in the use of FBL (Peterson et al., 2017; Carraway-Stage et al., 2014).

Addressing these areas "underneath the surface" (levels 2-4) is critical to change the overall FBL system. That is, if future research and interventions occur solely at the surface level (level 1), the same underlying factors and mental models that teachers currently hold, will continue to dictate the outcome of the system, and aside from minor 'cosmetic' changes at the events level, we will "continue to get out of the system what we've always got". However, by impacting the underlying structures and mental models affecting teachers, the entire system can be fundamentally altered and a new system, supportive of FBL and aligned with teachers' inherent values and beliefs, emerges.

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## APPENDIX A: IRB APPROVAL

**EAST CAROLINA UNIVERSITY**
**University & Medical Center Institutional Review Board**
4N-64 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** Fax **252-744-2284** **rede.ecu.edu/umcirb/**

Notification of Continuing Review Approval: Expedited

| | |
|---|---|
| From: | Social/Behavioral IRB |
| To: | Virginia Stage |
| CC: | |
| Date: | 10/28/2021 |
| Re: | CR00009471<br>UMCIRB 18-002749<br>PEAS (Preschool Education in Applied Sciences) |

The continuing review of your expedited study was approved. Approval of the study and any consent form(s) is for the period of 10/28/2021 to 10/27/2022. This research study is eligible for review under expedited category # 7. The Chairperson (or designee) deemed this study no more than minimal risk.

As the Principal Investigator you are explicitly responsible for the conduct of all aspects of this study and must adhere to all reporting requirements for the study. Your responsibilities include but are not limited to:

1. Ensuring changes to the approved research (including the UMCIRB approved consent document) are only initiated with UMCIRB review and approval except when necessary to eliminate an apparent immediate hazard to the participant. All changes (e.g. a change in procedure, number of participants, personnel, study locations, new recruitment materials, study instruments, etc.) must be prospectively reviewed and approved by the UMCIRB before they are implemented;

2. Ensuring that only valid versions of the UMCIRB approved, date-stamped informed consent document(s) are used for obtaining informed consent (consent documents with the IRB approval date stamp are found under the Documents tab in the ePIRATE study workspace);

3. Promptly reporting to the UMCIRB all unanticipated problems involving risks to participants and others;

4. Applying for continuing review and receive approval of continuation of the study prior to the study's current expiration date. Application for continuing review should be submitted no less than 30 days prior to the expiration date. Lapses in approval (i.e. study expiration) should be avoided to protect the safety and welfare of enrolled participants and liability to the University; and

5. Submission of a final report when the study meets the UMCIRB criteria for closure. Study approval should not be allowed to expire simply because the study is completed, rather the UMCIRB should be formally notified of study completion via the final report process.

The approval includes the following items:

| Document | Description |
|---|---|
| Addendum to Amendment #7 - Summary of Changes(0.01) | Study Protocol or Grant Application |
| Amendment #10 - Summary of Changes.docx(0.02) | Study Protocol or Grant Application |
| Appendix A Edu Manager Survey 071320.docx(0.01) | Surveys and Questionnaires |
| Appendix A_Education Manager Survey UPDATED 100820.pdf(0.01) | Surveys and Questionnaires |
| Appendix B Edu Coord Recr Flyer jmb.pptx(0.01) | Recruitment Documents/Scripts |
| Appendix C Educ Coordinators_Email_Script jmb.docx(0.01) | Recruitment Documents/Scripts |
| Appendix D Ed Coord Survey Consent.docx(0.01) | Consent Forms |
| Appendix E Teacher Survey 071320.docx(0.01) | Surveys and Questionnaires |
| Appendix F Interview-Survey Teachers Informed Consent.docx(0.01) | Consent Forms |
| Appendix G Teachers_Email_Script PEAS .docx(0.01) | Recruitment Documents/Scripts |
| Appendix H Teacher Recr Flyer 062420.pptx(0.01) | Recruitment Documents/Scripts |
| Appendix I TEACHER_InterviewGuide 071320.docx(0.01) | Interview/Focus Group Scripts/Questions |
| Appendix J PLC Teacher Recr Flyer Interview 7.7.20.pptx(0.01) | Recruitment Documents/Scripts |
| Appendix J PLC Teacher Recr Flyer Interview REVISED 032721.pptx(0.01) | Recruitment Documents/Scripts |
| Appendix K PLC_Teachers_Email_Script PEAS Interview ADP 7.7.20.docx(0.01) | Recruitment Documents/Scripts |
| Appendix K PLC_Teachers_Email_Script PEAS Interview REVISED 032721.docx(0.01) | Recruitment Documents/Scripts |
| Appendix L HPLC Interview Teacher Consent REVISED 032621(0.02) | Consent Forms |
| Appendix L HPLC Interview Teachers Informed Consent 7.7.20.docx(0.01) | Consent Forms |
| Appendix M HPLC_TEACHER_InterviewGuide_7_7_20.docx(0.01) | Interview/Focus Group Scripts/Questions |

| | |
|---|---|
| Appendix N PreschoolScienceMaterialsCheck UPDATED 100820.pdf(0.01) | Surveys and Questionnaires |
| Appendix N Tu Tool Revised 062520.docx(0.01) | Surveys and Questionnaires |
| Appendix O STEBI.docx(0.01) | Surveys and Questionnaires |
| Appendix P ORIC Survey Formatted.doc(0.01) | Surveys and Questionnaires |
| Appendix Q Cog Interview Teachers Informed Consent.docx(0.01) | Consent Forms |
| Appendix R Cognitive Interview Guide.docx(0.01) | Interview/Focus Group Scripts/Questions |
| Education Manager Original Consent Summary in REDCAP.docx.docx.docx(0.01) | Recruitment Documents/Scripts |
| Education Manager Study Summary NEW Text for REDCap Survey 100820.docx(0.01) | Recruitment Documents/Scripts |
| Education Manager Survey Eligibility Screener 100820.docx(0.01) | Surveys and Questionnaires |
| Letter to Participant - Notice of Compensation Change for PLC Survey & Interview(0.02) | Consent Forms |
| NIH SEPA Grant - PEAS 2018(0.01) | Study Protocol or Grant Application |
| PEAS Needs Assessment Protocol- March 2021 032621.docx(0.02) | Study Protocol or Grant Application |
| PEAS Needs Assessment Protocol- May 2020 071320.docx(0.03) | Study Protocol or Grant Application |
| Summary of Amendment #8 Changes October 2020.docx(0.01) | Study Protocol or Grant Application |
| Teacher Sci Ed Survey Original Consent Summary in REDCAP.docx.docx(0.01) | Recruitment Documents/Scripts |
| Teacher Sci Educ Eligibility Screener 100820.docx(0.01) | Surveys and Questionnaires |
| Teacher Sci Educ Study Summary NEW Text for REDCap Survey 100820.docx(0.01) | Recruitment Documents/Scripts |

For research studies where a waiver or alteration of HIPAA Authorization has been approved, the IRB states that each of the waiver criteria in 45 CFR 164.512(i)(1)(i)(A) and (2)(i) through (v) have been met. Additionally, the elements of PHI to be collected as described in items 1 and 2 of the Application for Waiver of Authorization have been determined to be the minimal necessary for the specified research.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

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IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418

**APPENDIX B. Head Start Recruitment Script**

Hello, is this [NAME OF PROGRAM] Head Start? Wonderful. May I speak with your education manager?

**If asked to identify self:** My name is _____ and I work East Carolina University in the Food-based Early Education Lab, FEEd for short.

**If after transferred, you get a voicemail, write down Education Manager's Name (from Voicemail)**
**_____**

**Then leave Voice Mail:**
Good morning/afternoon! My name is _____ and I work at East Carolina University in the Food-based Early Education Lab, FEEd for short. We've recently received a National Institutes of Health grant to support the development of science education resources for Head Start programs in NC. Right now, we are in the process of conducting a needs assessment to make sure we are meeting everyone's needs. We would love to include [NAME OF PROGRAM] to ensure we are meeting your needs too. If you have a few minutes to chat, please give me a call back at _____. Hope you have a wonderful day!

**If Education Manager Answers:** Hi! My name is _____
and I work at East Carolina University in the Food-based Early Education Lab, FEEd for short. . How are you doing today?
[Small Talk]

Well great! I'm calling because we've recently received a National Institutes of Health grant to support the development of science education resources for Head Start programs in NC. Right now, we are in the process of conducting a needs assessment to make sure we are meeting everyone's needs. We would love to include [NAME OF PROGRAM] to ensure we are meeting your needs too. Do you have a few minutes to chat?

**If no:** Okay, I understand. Thank you for your time. I hope you have a wonderful day!
**If they say they need to talk to their director first:** Okay! If it's easier, I can call and talk with your director directly if that would be helpful?
**If they say they would like you to talk to director:** That is no problem. Can I get their name and phone number please? _____
**NOTE: If you are not able to get Director name/info, you should be able to look up online**

**If yes:** Wonderful! Right now, we are doing a needs assessment to explore programs current science education practices, training opportunities, and classroom resources. This information will help us know how to best serve different programs across the state. We're collecting information through online surveys and interviews. For you as the education manager we have an online survey. For teachers, we have an online survey and an opportunity to also participate in a telephone interview.

If your program is interested in participating, we can also send you a summarized report of our findings in time for inclusion in your annual report for next year.

After this needs assessment, our next steps will be to develop a professional development for teachers that reflects what they actually want and need! Then, over the next few years, we will continue to partner

with Head Start programs across the state to implement these professional development opportunities to support STEM learning in your classrooms!

Does this sound like something you would be interested in?

**If no:** Okay, I understand. Thank you for taking the time to talk to me anyways! I appreciate your consideration!
**If yes:** Great! To get started, we'd like to email your teachers to tell them about the opportunity to participate. We would only use their emails to send the survey and nothing else. Would this be okay?

**If no:** Okay, I understand. Would you be comfortable if I compose the email and send it to you and you could forward it to your teachers and cc me on it so they can reach out if they are interested?
**If yes:** Wonderful. Let me give you the email to send the list to – it's carrawaystagev@ecu.edu

And then if you would be willing to participate in the online survey for education managers, I can send that to you via email as well. Would you be willing to share your insight with us as well?

**If no:** Alright, no problem!
**If yes:** Great! What is your email address? _____

I think that is everything for now. Thank you again for taking time to talk with me! I will be reaching out to you/your teachers in the near future. If you think of any questions or comments for me, please do not hesitate to reach out. My phone number is _____. You can also reach the director of the FEEd Lab, Virginia Stage at 252-744-1001 with any questions or concerns. I hope you have a wonderful day!

**Possible Questions:**

**What about incentives? How will teachers be compensated for their time? Will this be paid?**
Both teachers and education manager who complete the online survey be compensated for their time by being entered into a drawing for a gift card. Teachers who complete a telephone interview will be compensated with a $30 gift card because this is outside the scope of the requirements for their job. Also, I want to emphasize that none of these things are an assessment of you, your teachers, or your program. We are simply trying to deepen our understanding of what the current state of STEM learning is in the classroom.

**How long are the surveys? What is the time commitment?**
We know everyone is very busy these days. The surveys are short, they take about 20 minutes to fill out and it's all online. The optional interviews that teachers can participate in take around 45-60 minutes.

**NOTE: If you are asked a question you don't know the answer to, if you can text Stage (910-494-5406) discreetly while on phone OR say you are unsure of the answer but can find out and give a call back.**

**Other Questions Asked:**

## APPENDIX C. HEAD START TEACHER INTERVIEW RECRUITMENT FLYER

**APPENDIX D. STATEWIDE TEACHER SURVEY/INTERVIEW CONSENT FORM**

**Title of Research Study:** Understanding the State of Science in North Carolina Head Start Programs: A Needs Assessment

**Sponsor/Funding Source:** National Institutes of Health (NIH), National Institute of General Medical Sciences, Science Education Partnership Award

**Principal Investigators:** Virginia C. Stage, PhD, RDN (Persons in Charge of this Study)
**Department or Division:** Department of Nutrition Science
**Address:** Health Sciences Building (Suite 2307), East Carolina University Greenville, NC 27858
**Telephone #:** 252-744-1001

Researchers at East Carolina University (ECU), North Carolina State University (NCSU), University of North Carolina at Greensboro (UNCG), and North Carolina A&T (NC A&T) study issues related to society, health problems, environmental problems, public policy, behavior problems, and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

**Study Summary**

This purpose of this study is to gain a clearer understanding of Head Start programs' needs, assets, and resources related to science education. The information obtained in this study will assist researchers in creating teacher professional development resources that align with the needs of North Carolina-based Head Start Teachers. Eligible participants must be over the age of 18 years and currently employed as a Lead or Assistant Teacher in a North Carolina Head Start program. If you choose to take part in this study, you will be asked to complete a survey, or a survey and interview (optional). In the first part of the study you will be asked to complete an online survey that will take approximately 15 to 20 minutes. During the second part you will be given the opportunity to also participate in one 45 to 60 minute telephone interview. At the conclusion of the interview, the researcher will take approximately 10 minutes to review a brief written summary of the interview with you and ask you to confirm accuracy or correct inaccuracies of our interpretation of the interview. There are no known risks (the chance of harm) associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. If you are interested in learning more about this study, please continue to read the information below.

Why am I being invited to take part in this research?
You are being asked to take part in this research because you are a Head Start Teacher (Lead or Assistant) in North Carolina. To help us better understand what is happening around science and nutrition education, this research will consist of two parts:

- **PART I (Survey):** You will be asked to complete an online survey about (1) science education in the classroom, how you talk about science with children, and food-based learning,(2) teacher training and professional development, and (3) priority of science education in the classroom. You will also be provided with the opportunity to complete an optional survey about your experience with COVID-19's (the coronavirus disease caused by the severe acute respiratory syndrome) impact.
- **PART II (Interview)**: You will be asked to complete a telephone interview. In the interview we will discuss your experiences, challenges, and needs related to science and nutrition education practices with 3-5-year-old children in your Head Start program.

The decision to take part in this research is yours to make. By doing this research, we hope to gain a clearer understanding of North Carolina Head Start programs specific needs, assets, and resources related to science learning environments. Findings from this research will enable our team to create teacher professional development resources related to science and nutrition education that align with the needs of North Carolina-based Head Start teachers.

If you volunteer to take part in this research, you will be one of about 100 people across the state of North Carolina to do so.

Are there reasons I should not take part in this research?
Participants must be over the age of 18 years and employed as a Teacher (Lead or Assistant) within a Head Start program in North Carolina.

**What other choices do I have if I do not take part in this research?**
You can choose not to participate in this research. Choosing not to participate in the study will not affect your relationship with your work site or ECU, NCSU, UNCG, or NC A&T.

**Where is the research going to take place and how long will it last?**
The research will be conducted via an online survey with the option of also completing an interview over the phone. The online survey can be completed any time before the scheduled telephone interview. Online surveys can be completed at a place of your choosing. If you choose to also participate in the interview, a specific date and time for the interview will be scheduled during a time that is convenient for you. The total amount of time you will be asked to dedicate to this study is no more than 90 minutes: 15-20 minutes for the online survey, 45-60 minutes for the telephone interview, and 10 minutes reviewing the summary of your interview.

**What will I be asked to do?**
You will be asked to do the following:

1. Complete a 50-item online survey with an option 28-item add-on survey about COVID-19. The survey is broken down into the following sections:
   Section A: Science Education Practices (11 items)
   Section B: Training & Professional Development (25 items)
   Section C: Priority for Science Education, Science Talk with Children, & Food-based Learning (4 items)
   Section D: Tell Us About Yourself (10 items)

Section E: Your Experiences with COVID-19's Impact (28 items) (*Optional Survey*)

2. Complete one 45-60-minute telephone interview about science and nutrition education practices in your classroom, training and professional development practices, and priority level for science and nutrition education in the classroom.
3. Review a brief written summary of the interview and confirm accuracy or correct inaccuracies of our interpretation of the interview.

**What might I experience if I take part in the research?**
We don't know of any risks (the chance of harm) associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. We don't know if you will benefit from taking part in this study. There may not be any personal benefit to you, but the information gained by doing this research may help others in the future. Your specific responses will not be shared with your respective employers or other government agencies.

**Will I be paid for taking part in this research?**

You will receive a $30 gift card as compensation for your time for completing both the survey **and** interview.

If you choose to complete only the survey, you will be entered into a drawing for a $95 gift card.

If you choose to complete the optional questions about COVID in the survey (Section E), you will be entered into a second drawing for a $95 gift card.

You will be entered separately for each raffle. Each person has a separate and equal chance to win. However, to ensure fairness, one individual will not be eligible to win both raffles. Raffle winners will be notified at the of the study (Spring 2021).

**Will it cost me to take part in this research?**
It will not cost you any money to be part of the research.

Who will know that I took part in this research and learn personal information about me?
ECU, NCSU, UNCG, and NC A&T and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may also use your private information to do this research:

- The sponsors of this study (National Institutes of Health)
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

**How will you keep the information you collect about me secure? How long will you keep it?**
Data from the surveys will be stored electronically on the PI's Pirate Drive (an online, password-protected, secure storage folder accessible only by the study team members). All computers with access to the Pirate Drive are password protected and available only to authorized personnel. Hard copies of data (e.g. transcribed interviews) will be stored in a locked file cabinet in a locked office in Health Sciences Suite 2703. Within three years after the conclusion of the study, survey files and the digital recordings will be erased. Participants' name, phone number, and email address will be recorded so we can remind the

participant of the time and location for the in-depth interview (if applicable), however, this information will be stored separately from de-identified data. Participants will be given an identification number. Further, code names will be used for interviews. Traditionally, no identifying information is included in the interview, but the participant might inadvertently reveal identifying information that will be de-identified on any transcripts produced from the audio recordings. The use of a pseudonym will help ensure participants cannot be identified from the interview recording after it has been de-identified.

What if I decide I don't want to continue in this research?
You can stop at any time after it has already started. There will be no consequences if you stop and you will not be criticized. You will not lose any benefits that you normally receive.

Who should I contact if I have questions?
The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact Virginia C. Stage at 252-744-1001 (Monday-Friday, between 8:00A and 4:00P).

If you have questions about your rights as someone taking part in research, you may call the University & Medical Center Institutional Review Board (UMCIRB) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director for Human Research Protections, at 252-744-2914.

**I have decided I want to take part in this research. What should I do now?**
The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I know that I can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

_____

_____
**Participant's Name (PRINT)** **Signature** **Date**

**Person Obtaining Informed Consent**: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above and answered all of the person's questions about the research.

_____

_____
**Person Obtaining Consent (PRINT)** **Signature** **Date**

## APPENDIX E. QUALITATIVE INTERVIEW GUIDE

1I

**OPENING**

Hello, [insert teacher or administrator name]. We've been emailing, but in case we haven't met yet, I want to take a chance to introduce myself. My name is _____ and I work as a research assistant at East Carolina University. How are you doing today? [Small Talk]

Wonderful!

Well I first want to thank you for your time! Before we start, I'm going to go over some logistics of the interview and just so you know, this part is a little awkward so hang with me and we'll get our conversation going soon! Does that sound good?

We're excited to talk with you today because the purpose of this study is to learn more about science learning environments for 3-5-year-olds in your Head Start classroom. We really want to focus on your experiences, challenges, and needs related to science learning in your classroom.

Now there's no doubt that COVID-19 may have changed some of what you do in your classroom. So instead, we're going to focus our conversation on your experiences, challenges, and needs **prior** to the impact of COVID-19. And as a refresher, in North Carolina, COVID-19 appeared at the beginning of March 2020, so think about the time period before that date. But at the end of the interview you'll have a chance to talk about changes that have happened related to COVID-19, so there will be time to talk about COVID-19 as well.

As a reminder, your participation in this study is completely voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. Your choice to participate in this study, or not, will not affect your relationship with your work site, ECU, NCSU, UNCG, or NC A&T.

Alright, if this all still sounds good, and you still agree to participate in this study, our interview will last about 45-60 minutes. At the end of the interview I will take about 10 minutes to review what we discussed to make sure I got everything right. It's best if you can find a quiet, secluded place to sit during your participation in the interview. And just so you know, I will be taking notes throughout the interview and will also audio-record the session. So if you hear silence on my end, I'm here either taking notes or taking a sip of water.

Do you have any questions so far?

Great! We're almost ready to go!

[Audio recorder]: As previously mentioned, I would like to use an audio recorder during the discussion so that I can refer back to the discussion when I write my research report. Do you mind if I record this interview session?

a . (NO) Thank you!

b . (YES) OK. I'm afraid we have to audio record the interview. Because of that, you will not be able to participate in the interview today. Thank you for your time.

[PRESS BUTTON HERE]

Okay, it's on. You are now being recorded.

Great!

Now before we start, can you provide an **alternate name** for yourself? Basically, I would like you to make up a name that's not your real name, for me to call you. That way, your actual name is never recorded. Do you have a name I can call you?

Great! Let's get started [insert name]!

2I

**INTERVIEW**

Okay [name], we'll start off with some fun questions to get our conversation going.

Remember, I am interested in hearing your opinions about your experiences, challenges, and needs when you are teaching science in your classroom prior to March when COVID-19 began appearing in North Carolina. With that in mind, please give me a lot of examples and tell stories. No information is too simple or too complex. But when you tell stories, please do not refer to people in your stories by their real name. You can make up an alternate name for that person or refer to them by their relationship to you.

At the end of our talk, I'll recap our conversation and give you a chance to add to or correct anything to make sure I've got everything right.

Do you have any questions before we start?

**INTRODUCTORY QUESTIONS**

1. Prior to COVID-19, what was your favorite thing about science to teach preschoolers and why?

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

2. What comes to mind when you hear the words preschool science education?

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

**PRIOR TRAINING/EXPERIENCE IN SCIENCE EDUCATION**

Transition: Thank you for sharing! Okay, for the first topic, let's talk about the types of training and experiences you've had in teaching preschoolers about science in your classroom.

3. Can you tell me about any types of training you've had in teaching preschoolers about science?

| ✓ | **REQUIRED PROBES** | **OPTIONAL PROBES** | **GENERAL PROBES** |
|---|---|---|---|
| | a. Have any of these or other trainings included how to ***talk about science*** with preschool children?<br>If yes: Can you tell me more about that training?<br>If no: "Okay." | Where did you have this training?<br><br>Who provided this training? | Can you describe this training more?<br><br>Can you describe that experience more?<br><br>Can you tell me more about that? |
| | b. Have any of these trainings included how to ***use food as a tool*** to teach preschool children about science?<br>If yes: Can you tell me more about that training?<br>If no: "Okay." | | |

Optional Probe: Use only if participant does not state where training(s) occurred or (e.g. in-service, college courses, licensure)

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

**CURRENT PRACTICES IN SCIENCE EDUCATION**

Transition: Thanks for sharing that! For the second topic, let's talk about what was happening with science education in your classroom prior to the impact of COVID-19.

**Science Activities & Lessons**

4. To start, can you describe some activities or lessons that you've used in the past school year, prior to COVID-19, to teach children about science?

| ✓ | REQUIRED PROBES | OPTIONAL PROBES | GENERAL PROBES |
|---|---|---|---|
| | a. What are some factors that influenced which science activities or lessons you taught prior to COVID-19? | Use if asked for clarification: Think about the types of science activities you did in the classroom prior to COVID-19. | Can you think of anything else? |
| | b. Can you give me an example of your favorite science lesson or activity you used prior to COVID-19? | | Can you tell me more about this? |
| | c. How did you know when you were doing a good job of **teaching** about science? | What types of materials were needed? | Can you think of anything else? |
| | d. How did you know when you were **struggling** to do a good job teaching about science? | Was this lesson or activity from a curriculum? If so, do you know which curriculum it was? | |
| | e. How did your standard of determining if you were doing a good job or struggling compare to what your supervisor expected of you? | | |

Optional Probe 1: Use only if participant does not describe materials used in the pre-planned activity they describe.

Optional Probe 2: Use only if participant does not state that the lesson was from a curriculum and/or do not state which curriculum it was from.

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

5. When you talked to children about science prior to COVID-19, what did you talk to them about?

| ✓ | **REQUIRED PROBES** | **GENERAL PROBES** |
|---|---|---|
| | a. Thanks for sharing that! Before COVID-19, what would you say influenced your "*Science* Talk" or how you talked about science with children? Just as a reminder, "*Science Talk*" is simply engaging children in scientific discussion using scientific practice words like observe, describe, compare, predict, experiment, reflect. Science talk can happen with any topic related to science. So again, the question is, before COVID-19, what influenced your "*Science* Talk" or how you talked about science with children?<br>[**NOTE:** Allow participant to describe what they talk about before providing the definition of science talk.]<br>b. How did your standard of determining if you were doing a good job or struggling compare to what your supervisor expected of you? | Can you think of anything else?<br><br>Can you give me another example about this?<br><br>Why or why not? |
| | | |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

6. Now that we have discussed science learning in detail, can you describe any activities or lessons you've done prior to COVID-19, that combine science with other subjects?

| ✓ | **REQUIRED PROBES** | **OPTIONAL PROBES** | **GENERAL PROBES** |
|---|---|---|---|
| | a. If yes: Can you give me an example of how you have combined multiple subjects?<br>If no: Okay.<br><br>b. What topic was the primary focus of the lesson?<br>[**NOTE**: Use if it is not clear from the description whether science was the primary or secondary focus] | <u>If asked for clarification say:</u><br>Think about the types of science activities, you have done in the classroom and what subjects they have involved. | Can you explain this more?<br><br>Can you give another example? |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

**Supports & Challenges to Teaching Science**

Transition: Thank you for sharing all of that, I am learning a lot. Now we're going to talk about your supports and challenges to teaching science.

7. Can you list some things that have helped or supported you when you have taught science in the classroom prior to COVID-19? This can be people, places or things.

| ✓ | REQUIRED PROBES | GENERAL PROBES |
|---|---|---|
| | a. I heard you list **[say what they listed as supports]** as supports, are there any others you would like to add? | Can you explain this more?<br><br>Can you think of anything else?<br><br>Can you give me an example?<br><br>Why or why not? |
| | b. Which of these supports you've listed do you think helped the most? | |
| | c. How did having this help or support influence which activities or lessons you did in the classroom? | |
| | d. Can you give me a detailed example, like a story, about how **[list what they said was most helpful]** has helped you teach science with children prior to COVID-19? | |

| **REVIEW PROBES- "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

8. Can you list some challenges you faced when doing science activities and lessons in your classroom prior to COVID-19? This can be people, places, or things.

| ✓ | REQUIRED PROBES | GENERAL PROBES |
|---|---|---|

| | | |
|---|---|---|
| | b. I heard you list **[say what they listed as challenges]** as challenges, are there any others you would like to add?<br><br>c. Which of these challenges you've listed do you think is the biggest?<br><br>d. How did this challenge affect which science activities and lessons you did in the classroom prior to COVID-19?<br><br>e. Can you give me a detailed example, like a story, about how **[list what they said was most challenging]** has been a challenge for you while you taught science with children prior to COVID-19? | Can you explain this more?<br><br>Can you think of anything else?<br><br>Can you give me an example?<br><br>Why or why not? |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

**Opinions & Motivators**

9. In your opinion, what are some reasons you should engage preschool children in science?

| ✓ | **REQUIRED PROBES** | **GENERAL PROBES** |
|---|---|---|
| | a. On the contrary, what do you think are some reasons you should not engage preschool children in science? | Can you explain this more?<br><br>Can you think of anything else?<br><br>Why or why not? |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| *Did I get that right?* |
| *Do you have anything else to add?* |

**Food-based Learning Activities & Lessons**

Transition**:** Thank you for sharing your experiences on science and science talk. Now we're going to transition to talk about what types of food experiences or activities you have used in your classroom to teach children about science.

10. Can you describe some lessons or activities that you have used in the last year, prior to COVID-19, to teach children about science using food? Remember, nutrition is a science too so be sure to think about all the science topics you teach with food.

| ✓ | **REQUIRED PROBES** | **OPTIONAL PROBES** | **GENERAL PROBES** |
|---|---|---|---|
| | a. If activity described appears to be preplanned ask: Can you give me an example of a time you use food as a teaching tool that was not preplanned?<br><br>If activity appears to be unplanned ask: Can you give me an example of a time you used food as a teaching tool that was planned?<br><br>b. What are some things that have influenced your ability to use food experiences as a teaching tool in the classroom?<br><br>c. How did you know when you were doing a good job of **incorporating** food experiences?<br><br>d. How did you know when you were **struggling** to do a good job incorporating food experiences?<br><br>f. How did your standard of determining if you were doing a good job or struggling | Use if asked for clarification: Think about the types of food experiences you did in the classroom prior to COVID-19.<br><br>What types of materials were needed?<br><br>Was this lesson or activity from a curriculum? If so, do you know which curriculum it was?<br><br>When you talk to children about nutrition, what do you talk to them about? | Can you think of anything other examples?<br><br>Can you tell me more about this? |

| | | | |
|---|---|---|---|
| | compare to what your supervisor expected of you? | | |

Optional Probe 1: Use only if participant does not describe materials used in the pre-planned activity they describe.
Optional Probe 2: Use only if participant does not state that the lesson was from a curriculum and/or do not state which curriculum it was from.
Optional Probe 3: Use only if participant does not mention what nutrition-related concepts they talk about with children.

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| *Did I get that right?* |
| *Do you have anything else to add?* |

**Supports & Challenges To Incorporating Food Experiences**

Transition: Thank you! Now we're going to talk about your supports and challenges to incorporating food experiences to teach science in your classroom.

11. Can you list things that have helped or supported you when you have incorporated food experiences in your classroom prior to COVID-19? This can be people, places or things.

| ✓ | **REQUIRED PROBES** | **GENERAL PROBES** |
|---|---|---|
| | e. I heard you list **[say what they listed as supports]** are there any others you would like to add? | Can you explain this more?<br><br>Can you think of anything else? |
| | f. Which of these supports you've listed do you think helped the most? | Can you give me an example? |
| | g. How did having this help or support influence which activities or lessons you did in the classroom? | Why or why not? |
| | h. Can you give me a detailed example, like a story, about how **[list what they said was most helpful]** has helped incorporate food experiences in your classroom prior to COVID-19? | |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |

| Do you have anything else to add? |
|---|

12. Can you list some challenges you faced when incorporating food experiences in your classroom prior to COVID-19? This can be people, places, or things.

| ✓ | REQUIRED PROBES | GENERAL PROBES |
|---|---|---|
| | e. I heard you list **[say what they listed as challenges]**, are there any others you would like to add? | Can you explain this more?<br><br>Can you think of anything else? |
| | f. Which of these challenges you've listed do you think is the biggest? | Can you give me an example? |
| | g. How did this challenge affect which science activities and lessons you did in the classroom prior to COVID-19? | Why or why not? |
| | h. Can you give me a detailed example, like a story, about how **[list what they said was most challenging]** has been a challenge for you while you incorporated food experiences with children prior to COVID-19? | |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| *Did I get that right?* |
| *Do you have anything else to add?* |

**Opinions & Motivators**

13. In your opinion, what are some reasons you should use food experiences to teach science to preschool children?

| ✓ | REQUIRED PROBES | GENERAL PROBES |
|---|---|---|
| | a. On the contrary, what do you think are some reasons you should not incorporate food experiences to teach science to preschool children? | Can you explain this more?<br><br>Can you think of anything else?<br><br>Why or why not? |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| *Did I get that right?* |
| *Do you have anything else to add?* |

**FUTURE STATE: CHANGES & PROGRAM/TEACHER NEEDS**

Transition: Thank you for all your sharing so far about your experiences prior to COVID-19! We are on the last topic talking about your **present** needs and challenges. We want to create professional development resources that meet what your needs actually are. To do this, we need to know what, if any, changes are needed and any professional development opportunities that you would like to see in the future.

14. To start, what skills, experiences, or training opportunities do you feel you need to provide strong science education to your preschool-aged children?

| ✓ | REQUIRED PROBES | GENERAL PROBES |
|---|---|---|
| | a. What are some science topics you might want to learn more about?<br><br>b. What are some food experience topics you might want to know more about? | Can you explain this more?<br><br>Can you think of anything else?<br><br>Why or why not? |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

15. We have just discussed all the different aspects of science education and food experiences in your classroom prior to COVID-19. Lastly, in what ways has COVID-19 already impacted your current science classroom?

| ✓ | **REQUIRED PROBES** | **GENERAL PROBES** |
|---|---|---|
| | a. How might COVID-19 impact your use of science talk? | Can you explain this more?<br><br>Can you think of anything else? |
| | b. How might COVID-19 impact your use of food experiences? | Why or why not? |
| | c. How else might COVID-19 impact your classroom as a whole? | |

| **REVIEW PROBES - "***I heard you say…."* |
|---|
| Did I get that right? |
| Do you have anything else to add? |

3|

**REVIEW**

Now, I'm going to take a few minutes to review what you've said. After each question I'm going to ask you if I got that right and if there is anything else you'd like to add. This is a very important step in the process to make sure we have the right information. Feel free to stop me at anytime and add anything that I may have missed.

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4|

**CLOSING**

That ends the major part of our interview that we will be recording, so I have turned our recorder off and you are not being recorded.

Now that the interview is over, I would like to thank you for taking time to talk with me! I learned lots of things from you today! Our next step will be to transcribe our interview and summarize what we discussed. Would you be willing to review our summary once it is completed to make sure we interpreted everything correctly?

(YES) Great! Is it better for me to send you an email or a hard copy?

Thank you! What is your (email address/home address)? _____

(NO) Alright! Not a problem!

Thank you again for your help! You have been generous with your time! Have a great rest of the day!