

DESIGN AND IMPLEMENTATION OF A GARDEN-BASED
SERVICE LEARNING PROGRAM FOR NUTRITION AND
DIETETIC STUDENTS: A CBPR APPROACH

A Thesis
by
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Abstract

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Our goal was to develop a garden literacy program tailored to undergraduate dietetic students to provide hands-on, service learning opportunities in gardening and nutrition education. A community-based participatory research (CBPR) approach was used to guide the program implementation at a local community garden. Participants ($n = 12$) were declared Nutrition majors, 18 years of age or older, and had limited previous garden knowledge. They completed a five-week curriculum taught by North Carolina Cooperative Extension educators. A mixed-method design was utilized which included pre/post surveys, semi-structured interviews, record keeping, filed notes, observations and photos. The process of garden implementation was evaluated using a logic model. Descriptive statistics were calculated using Excel, and interviews were coded using the Constant Comparative method by three trained researchers. A campus-community partnership was key in the development of the garden program. At baseline, average perceived knowledge of sustainability/gardening was 3.87/10 ($SD = 2.59$). Major benefits that emerged were increased connections to

community organizations, improved self-reported vegetable intake and local food purchasing, and enhanced self-efficacy for gardening and nutrition education. Participants agreed that the garden program could help prepare them for their future careers. Although gardens are now common in K-12 farm-to-school initiatives, there is a deficit of research on initiatives targeting college-aged students and specifically dietetic students. This project is important because it can guide the incorporation of garden education into undergraduate Dietetic programs.

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Table of Contents

Abstract.....	iv
Acknowledgments.....	vi
Foreword.....	viii
Chapter 1.....	1
Chapter 2.....	13
References.....	40
Appendix A.....	47
Vita.....	56

Foreword

Chapter 2 of this thesis will be submitted to *The Journal of Hunger and Environmental Nutrition*, a peer-reviewed journal which is published by Taylor & Francis. The thesis has been formatted in accordance with the style for that journal.

CHAPTER I

REVIEW OF THE LITERATURE

Fruits and Vegetables

Fruit and vegetables (F&V) are a central element in a healthy, balanced diet. They are key sources of vital nutrients, from fiber to vitamins and phytonutrients. F&V are low in calories, and they may play a role in weight management. The protective health benefits of F&V and the relationship to several chronic diseases, from cardiovascular disease, to obesity, and some cancers has been the subject of recent interest.¹⁻³

F&V Initiatives

Many F&V initiatives have been developed to support dietary intake for Americans. The 2010 Dietary Guidelines for Americans recommended to “fill half your plate with fruits and vegetables.”⁴ According to My Plate, combined F&V intake for adults aged 19 and above, was 4.0 cups/day/females, and 5.0 cups/day/males.⁵ In 1991, The “5-A-Day program”, was developed as a public health campaign to increase F&V intake to at least 5 servings per day.⁶ In California, the “A Garden in Every School” movement was prompted by the Centers for Disease Control and Prevention (CDC), as an initiative to develop healthy school environments^{3,7,8,9} From national to local programs, the importance of finding strategies to improve F&V intake among Americans has emerged as a central public health issue.

F&V Intake

Despite numerous public health intervention efforts, there is a gap between F&V recommendations and intake for Americans across age demographics.

One study examined current F&V intake trends for adults between 1988 and 2002 using NHANES III data. The researchers found a significant change in consumption between the two time periods, with 89% of the population not meeting recommended intake.¹⁰ According to the CDC- in 2005, recommended fruit intake of two or more times a day was achieved by only one out of three adults, and vegetable intake of three or more a day was consumed by only one out of four U.S. adults.⁹ In 2009, data collected from the Behavioral Risk Factor Surveillance System (BRFSS) indicated that states showed significant variability related to F&V consumption patterns, yet, no state met recommended levels.⁷

Correlates of F&V Intake

Variables associated with F&V intake are complex. For example, the 2009 BRFSS data set identified individual characteristics associated with increased F&V intake, which included female gender, aged 65 yrs. and above, college graduates, annual income \$50,000 or above, and a BMI within normal range.⁹ In contrast, low F&V consumption was associated with low socioeconomic status, reduced F&V access, and low self-efficacy score.¹¹

Throughout the literature there is a noted correlation between socioeconomic status and F&V consumption. NHANES data sets collected from 1988-1994 indicated that participants living in poverty were less likely to meet dietary recommendations for F&V intake ($p < 0.05$), and this trend was maintained in the 1999-2002 sample.¹⁰ Additionally, low income individuals are more likely to suffer from chronic diseases.¹² Low income individuals are at increased risk for food insecurity. Food insecurity is defined as “access by all people at all times to enough food for an active, healthy life. This must include: 1) ready availability of nutritionally adequate and safe foods and 2) ability to acquire foods in socially acceptable ways”.¹³ Data collected from 2008 estimated that nearly 14% of households in the US are

food insecure.¹² In a landmark study from 1996, F&V consumption was significantly related to food insecurity status. In this study, multiple 24-hour diet recalls and household food inventory assessments were performed with a sample of 200 low-income women. Results from the regression analysis indicated that as the households' level of food insecurity increased, both the amount of food in the home, and the F&V consumption frequency decreased.¹⁴

Barriers to F&V Intake

Throughout the literature, several studies have examined barriers to F&V consumption. In children, an understanding of F&V intake patterns is important because these behaviors are initiated in early childhood and track throughout development into adulthood. In a 2011 study, perceived barriers to a healthy diet and physical activity were assessed for children aged 4- to 12-years-old. From the 115 children sampled, the most commonly cited barriers to healthy eating were “my child likes to eat in front of the TV or at the computer,” “healthy foods cost too much,” and “my child doesn't like healthy foods.” Specifically, there was an association between the response: “my child doesn't like healthy foods” and a decreased F&V intake.¹⁵

Similarly, studies focusing on adult and low-income populations have identified perceived barriers to F&V consumption. Barriers cited by low-income adults to F&V consumption have previously included food preferences, cost, time, availability, and lack of knowledge and skills.¹⁶ In another study, focus groups of low income participants across North Carolina identified ten barriers to F&V access. These barriers included: cost, cooking and nutrition knowledge, convenience, quality, food preferences, availability, transportation, perishability, variety, and safety. In response, several intervention strategies were identified

to address these barriers including mobile markets, farmer's market assistance programs, and community gardens.¹⁷

Sustainability and Nutrition Educators

Nutrition and dietetic practitioners and educators are poised to be leaders in the promotion of healthy eating. Within the field, there is an increased emphasis on the connection between environmental and sustainability issues and human health. Sustainability is defined as, “the capacity of being maintained into the foreseeable future while meeting the needs of the present without compromising the ability to meet the needs of future generations.”¹⁸ In 1986, Gussow and Clancy published the Dietary Guidelines for Sustainability, linking nutrition and sustainable food choices. This paper advocated for nutrition professionals to understand our food system and the associated resource costs of dietary recommendations.¹⁹ In 2009, the term “civic dietetics” was coined by Wilkins to encourage food professionals to apply values of sustainable food systems to their practices.²⁰ In 2013, a position paper on ecological sustainability and the food system was distributed by the Academy of Nutrition and Dietetics. The paper recommended for nutrition professionals to be aware of sustainability issues and offered resources for practitioners.²¹

F&V promotion continues to be a key topic among community nutrition programming. However, additional focus is recommended for professionals to address issues of F&V access and availability. Several examples of model programs include community gardens, farmer's market initiatives and farm-to-school programs.^{17,21}

Previous Research in Community-Based Fruit & Vegetable Interventions

Several previous studies have focused on increasing F&V consumption by improving F&V access. In one qualitative study, focus groups were conducted with low-income

participants across North Carolina to examine participants' perceptions of common F&V access strategies, including mobile markets, farmers market EBT programs, and community gardens. After the thematic analysis of individual, community and policy level barriers by the 105 participants, mobile markets emerged as the most supported strategy.¹⁷

There is a correlation between reducing barriers to intake and improved F&V consumption in low-income populations. In one study, a Farmer's Market nutrition intervention for 666 WIC participants was designed that provided education and coupons. Results indicated an increased Farmer's Market attendance for those who received coupons (OR = 69.91, P<0.01), and a significant change in F&V consumption behaviors ($\beta=0.33$). Additionally, regression coefficient findings identified a significant association between receiving the education and change in attitudes about F&Vs ($\beta=0.17$).¹³ Research has identified multi-component interventions as one strategy to improve F&V consumption in families.

In a 2012 study, a randomized, parallel-group community wellness program was developed to target low-income family food preparers and their partners in rural Appalachia. After the eight-week intervention, participant scores in the highest stages of change were associated with a significant increase in frequency and intake of experimental vegetables.¹⁶

A recent trend in the literature is the focus on environmental interventions to improve healthy eating, and F&V consumption. For example, a nutrition education campaign, *Eat Well, Eat Local, Eat Together (Eat³)* was developed to combine nutrition with socio-ecological objectives to address healthy eating in rural New York counties. From the impact evaluation outcome data on self-reported responses, improved F&V consumption, local food purchasing and frequency of family meals emerged as key themes. These findings by

participant's supported the potential strength of environmentally grounded initiatives.²² However, the successful implementation of programs like these are complex and long-term sustainability is an important component. In this study, the program was successfully incorporated into the New York State Farmer's Market Nutrition Education Program.²² The literature has helped to identify program sustainability and funding as the most common barriers to F&V programs. Initiatives that tapped into existing resources and labor have emerged as the most successful long-term.²²

In addition, college students have been identified as one population at-risk for inadequate F&V consumption. In a 2010 study, nutrition-label use among a convenience sample of students from a two-year community college, and four-year university were examined through an online survey tool. Students who used nutritional labels had improved diet quality. For example, these students had a better F&V intake, compared to students who did not use these labels. From this sample of 1,201 students, the dietary variable of F&V was (5.3%) in frequent label readers, compared to (2.1%) for infrequent label readers. This study suggested nutrition education as an important possible mechanism for improving diet quality and F&V consumption in this young adult population.²³

Gardens

Gardens have been identified as one innovative tool to support F&V consumption in a variety of populations, from schools to low-income populations. Previously, gardens have been defined as, "plants grown in the ground, in raised beds, in pots, or in greenhouses in both classrooms or outdoors."²⁴

School Gardens

The trend in school gardens is embedded within the broader farm-to-school movement (FTS)- which includes local foods for school cafeterias, farm field trips, and

school learning gardens. The FTS movement has recently experienced a period of exponential growth. In 1998, there were ten farm-to-school programs.²⁵ In contrast, USDA FTS census data from 2013-2014 identified that 42,173 schools participated in some aspect of FTS activities.²⁶ There is unique variability within states regarding school garden policies. For example, in California, the *A Garden in Every School* initiative was developed, which led to an explosion in the creation of gardens across the state. In North Carolina in 2015, there were 67 out of 1,876 schools statewide that had an edible school garden.²⁷ It is estimated that over 7,000 school garden projects are currently registered across the country.²⁶

The school garden literature has identified program outcomes ranging from improved academic achievement, health and nutrition benefits, and family and community development. In a 1996 survey of California school principals, the most frequently mentioned purpose for having a school garden was to support academic achievement (89%). Gardens were most commonly used in elementary schools (64%), and in urban environments (73%).²⁴ A commonly cited barrier for school gardens was the lack of resources for schools, and the pressure to bridge gardens with existing academic curriculum.²⁴ In a follow-up assessment from the California Principal's study, 4th grade teachers 1,665 were surveyed on gardens within their schools. The results identified six key barriers, including: time (67%), teacher's interest (63%), teacher's experience (61%), teacher's garden knowledge (60%), lack of supporting curriculum materials tied to school standards (60%), and lack of teacher training in gardening skills (58%).²⁴

Several previous studies have focused on the potential health benefits of gardens, through the development of garden-based nutrition education initiatives. In a 2007 study, sixth-grade students participated in a 12-week combined nutrition and horticulture

intervention in Idaho. Participants received F&V exposure, hands-on learning, and nutrition education. A pre/post intervention assessment indicated that students significantly increased vegetable consumption by 1.44 servings. However, more research is needed to assess longevity of these behavior changes.²⁸ In a pilot test of the *Improving Children's Health through Farming Food and Fitness (CHF3) Program*, students in two California schools participated in a multi-component FTS program. The program included the creation of salad bars in schools, demonstrating curriculum connections to the garden, composting initiatives, and creation of a school garden program with nutrition education units. Survey data supported significantly improved health and nutrition knowledge for kindergartners, fourth and fifth graders.²⁹ Another study measured 93 YMCA summer camp participants in 4th to 6th grades. These students were exposed to garden activities, local F&V taste tests, and cooking / snack preparation with recipes and newsletters sent home to parents. Five key outcome measures connected to participant satisfaction and changes to the home environment were assessed. Outcome results from the study supported an increased F&V consumption in participants, increased fruits and vegetables exposure ($P < 0.001$), vegetable preferences ($P < 0.001$), and asking behaviors at home ($P < 0.002$).³⁰ This trend in school garden literature shows promising results on student's vegetable consumption through development of multi-component programs.

Community Gardens

Community Gardens are defined as, "land set aside for community members to grow edible or ornamental plants."³¹ Community gardens are highly diverse and represent complex organizations and goals. These range from increasing a community's food security, to expanding green spaces, and community wellness.³² In a 2012 sample of 445 community

garden organizations across the US and Canada, 73% of gardens were located in urban areas.³¹ In general, the community garden movement across the country is showing growth.³¹ Most commonly, community gardens are located on public lands (48%), followed by private lands (24%), and organizations (18%).³¹

Community gardens have been cited as one strategy to strengthen local foods systems and to improve citizen self-reliance.³³ A mixed method assessment of a community garden program for low-income families in southern Virginia, surveyed children, parents and key community stakeholders. The child surveys identified variables related to behaviors and interest related to gardening, with (68%) willing to work in a garden, and (82%) willing to eat produce from the garden.³⁴

There is a growing body of literature surrounding the potential for community gardens to address health goals for a community. In a 2008 study of 845 urban community gardeners and non-gardeners, 15% of the residents used a community garden. Of these gardeners, 32.4% of community gardener households met F&V recommendations, compared to 17.8% of non-gardener households.³⁵ Community garden implementation has received mixed reviews. In one study, focus group participants identified three potential barriers: safety, gardening knowledge, and logistics of operating gardens. In contrast, community gardens were believed by participants to improve community cohesion, and provide low-cost fresh produce.¹⁷

Gardens in Higher Education

There is very little published research regarding the use of gardens, and/or community gardens within collegiate education. Of the few studies that exist, educators within the fields of agriculture, education, and environmental studies have performed them.

Several studies described the application of student service-learning initiatives within a public health context. Service learning is defined as, “an experiential teaching and learning strategy that combines academic instruction with meaningful community service and guided reflection activities.”³⁶ In one example of a health promotion service-learning course for first year medical students, 500 students performed 56 community health interventions. Students learned community needs assessment skills and gained experiences with real-world health issues in the local region.³⁷ There are many cited benefits of service learning programs. In a garden-based service learning model of three interdisciplinary garden projects in Texas, benefits cited were: enhanced student’s academic achievement, strengthening community-campus connections, and supporting food justice advocacy within the local communities.³⁸

Several service-learning programs have previously been developed to connect gardening and dietetics students. In one 2007 study, a garden-based service learning initiative of dietetic students in Texas participated in a six-week basic garden literacy course at a local community garden. The students then applied their new knowledge through implementation of service projects in various community settings - from senior centers to area food banks.³⁹ In Ohio, the *ECOho Garden project* was developed to teach university stakeholders (dietetic students, teachers, and community members) hands-on gardening skills, with applied activities in a community garden setting. Stakeholders participated in a half-day organic gardening workshop taught by a variety of local experts and applied their knowledge through hands-on service projects throughout the community designed to help strengthen the local food system.⁴⁰ However, more research is need on the use of gardens within higher education, and specifically for nutrition and dietetics students.

Community-Based Participatory Research

Community based participatory research (CBPR) has been recommended previously in the literature as a potential strategy to be applied to garden-based intervention projects.³⁴ CBPR is a unique style of research that is known for the active involvement of the community participants in all aspects of the research design and implementation.^{34,41} The tenants of this style of research design are described in a review of the CBPR model used in public health as 1) assessment at the community, 2) seeking to identify, support, and utilize community resources, 3) active-partnership and collaboration, 4) action-oriented goals to apply the lessons learned to solve real community problems, 5) educational initiatives, 6) cyclic, 7) grounded in the positive model and the ecologic model, and 8) transfer of data/research outcomes to community.⁴¹

Limitations of CBPR have been cited in several research articles and reviews. One major concern of this methodology is the lack of standardization within the field of CBPR applied programs.⁴² This potentially could lead to discrepancies in the comparison of CBPR studies.⁴³

CBPR has become an important tool within the field of public health research, and specifically within health disparities. In 2012, one of the first known community garden interventions to utilize the CBPR methodology was performed. The researchers and community actively worked together throughout the study - first, through a series of four workshops with a diverse committee of community stakeholders (n = 28). The meetings were structured through the application of the comprehensive Planning and Participatory Evaluation (CPPE) process. The team developed priority interventions identified by the community and these were used to inform the research objectives. Secondary benefits of the

use of the CBPR model in this study were enhanced campus-community ties and trust, and a greater insight into community values and priorities.³⁴

Community based participatory research (CBPR) has been recommended previously in the literature as a potential strategy to be applied to garden-based intervention projects.

^{34,41-44} In this study, we developed a CBPR study of college-aged students in Nutrition & Dietetics to investigate the impact of an experiential garden-based service-learning program on garden literacy, attitudes, knowledge, and beliefs related to the use of gardens within community nutrition programming.

CHAPTER II
PROCESS EVALUATION OF GARDEN LITERACY PROGRAM
IMPLEMENTATION

Introduction

The protective health benefits of fruit and vegetables (F&V) and their relationship to several chronic diseases has been well established in the literature.¹⁻³ Yet, despite numerous public health intervention efforts, there continues to be a gap between F&V recommendations and intake for Americans across age groups. In 2005, the recommended vegetable intake of three or more servings a day was consumed by only one out of four United States (US) adults.^{8,9} From national to local programs, the importance of finding strategies to improve F&V intake among Americans has emerged as a central public health issue.

Barriers to F&V consumption in a variety of populations have been previously examined. Per data from the Behavioral Risk Factor Surveillance System (BRFSS), low F&V intake has been associated with low socioeconomic status, reduced F&V access, and a low self-efficacy score (a measure of one's confidence in their ability to perform a task or goal).¹¹ In one study of low-income participants in North Carolina, focus groups were performed to identify barriers to F&V access. Ten primary barriers emerged: cost, cooking and nutrition knowledge, convenience, quality, food preferences, availability, transportation, perishability, variety, and safety.¹⁷

Encouraging F&V consumption is a key theme among community nutrition programming. Nutrition and dietetic practitioners are poised to be leaders in the promotion of

healthy eating. Within the field, there has been a call for enhanced awareness of and emphasis on the connection between environmental issues and human health.²¹ Gardens have been identified as one innovative tool that can be used in a variety of settings—from community gardens, to farm-to-school programs, low-resource populations, senior centers, and more^{7,8}

The Farm-to-School (FTS) movement which is defined as a diverse and nuanced term for programs that generally focus on improving 1) student nutrition, 2) health and wellness engagement, and 3) support for local farmers.⁴⁵ FTS has recently experienced a period of exponential growth. In 1998, there were ten farm-to-school programs.²⁵ In contrast, USDA farm-to-school census data from 2013-2014, identified that 42,173 schools participated in some aspect of farm-to-school activities.²⁶ In North Carolina in 2015, there were 67 out of 1,876 schools statewide that had an edible school garden.²⁷

The school garden literature has shown encouraging programmatic outcomes ranging from improved academic achievement to health and nutrition benefits. In a 1996 survey of California school principals, the number one purpose for having a school garden was to support academic achievement (89%). Gardens were most commonly used in elementary schools (64%) and in urban environments (73%).²⁴ In a follow-up assessment from the California Principal's study, 4th grade teachers (n = 1,665) were surveyed about gardens within their schools. The results identified six key barriers to successful garden programming including: time (67%), teacher's interest (63%), teacher's garden knowledge (60%), teacher's experience (61%), lack of teacher training in gardening skills (58%), and lack of supporting curriculum materials tied to school standards (60%).²⁴

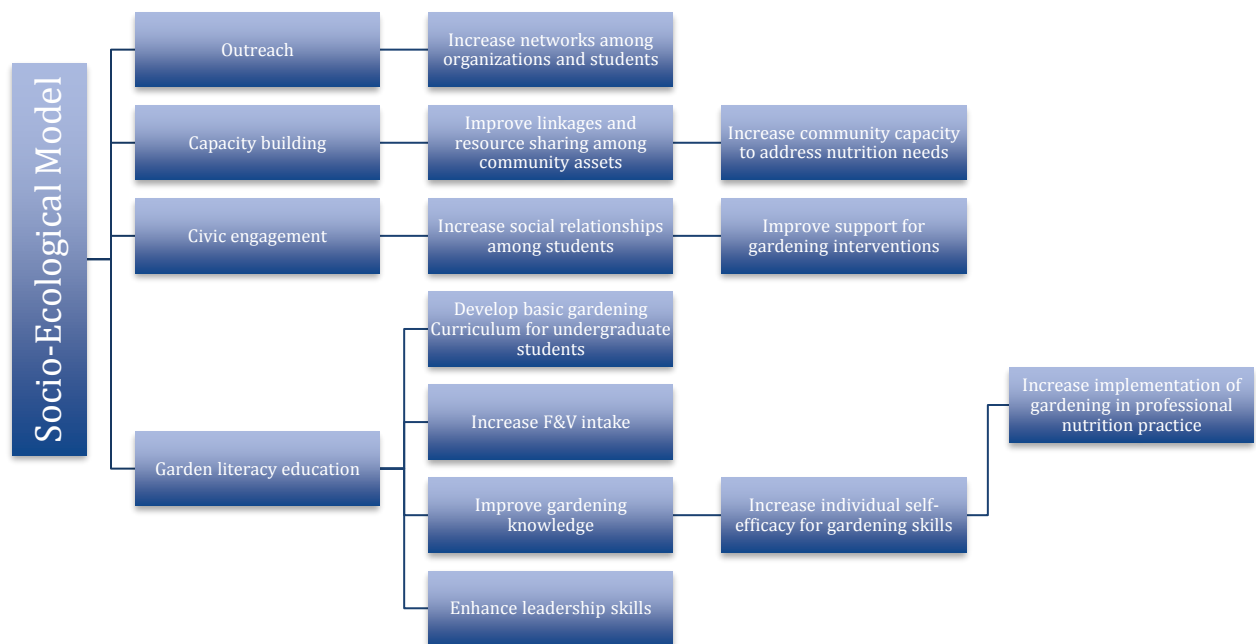
Rationale for Establishing a Garden-Based Service Learning Program for College Students

Use of gardens has been well documented within K-12 schools. In contrast, there is very little published research regarding the use of gardens within collegiate education; especially within nutrition and dietetic programs. Of the few studies that exist, gardens have been used in community nutrition education. In one 2007 study from Texas, dietetic students participated in a 6-week week basic garden literacy course at a local community garden. Then, students applied their new knowledge through implementation of service learning projects with various community populations: from senior centers to area food banks.³⁹ In Ohio, the Echo Garden project was developed in 2010 to teach university stakeholders (dietetic students, teachers, and community members) hands-on gardening skills, with applied activities in a community garden setting. Stakeholders participated in a half-day organic gardening workshop taught by a variety of local experts and applied their knowledge through hands-on service projects throughout the community designed to help strengthen the local food system.⁴⁰

It has been well-established in the literature that effective nutrition solutions must be multi-focal and complementary. Today's nutrition problems are linked to complex etiologic factors– including: social, biological, political, ecological, and more.^{6,9,11,16} Future nutrition professionals will need to be prepared to use interdisciplinary thinking to address these challenges. A lack of training for students in topics such as food production and gardening, may be leading to an agriculture-nutrition disconnect. This topic is especially relevant to nutritional programs focusing on increasing F&V intake among Americans. The inclusion of gardening and agricultural topics in nutrition and dietetics curriculums may help to better

prepare students and maintain food and nutrition leadership within the field. Figure 1 presents a conceptual model that outlines the role of a garden-based service learning program in preparing future nutrition leaders, especially Registered Dietitians, to promote F&V consumption and access to healthy foods.

Figure 1 Concept Model for the *HEN Garden Lab* project, Boone, NC



The goal of this study was to outline the process of planning and implementing a gardening program, called the *Hunger and Environmental Nutrition (HEN) Garden Lab*. The program participants were college-aged students majoring in Nutrition and Foods in Boone, North Carolina, the site of Appalachian State University. This study was grounded in the Socio-Ecological Theoretical Framework (a study of the relationships between people, culture, and the environment).⁴⁶ HEN Garden Lab used a community-based participatory research (CBPR) approach to identify the mechanisms involved in implementing a garden

education and service-learning program for undergraduates in a community garden setting. CBPR has been recommended previously in the literature as a potential strategy to be applied to garden-based intervention projects.³⁴ CBPR is a unique style of research that is known for the active involvement of the community in all aspects of the research design and implementation.^{34,41} The objective of this study was to describe the process of implementing the HEN Garden Lab Program with undergraduate nutrition and dietetics students by conducting a process evaluation.

Methodology

Study Setting

Watauga County, the site of this study, is a well-established agricultural community situated in Western North Carolina. Watauga County is home to Appalachian State University, a mid-size regional university which in 2014 enrolled 17,932 students.⁴⁷ The campus has developed a national reputation as an emerging leader in sustainability.⁴⁸ Watauga County is also home to a wide variety of existing gardens and infrastructure—from school gardens to community gardens, non-profit gardens, and faith-based gardens. Results from the 2015 Watauga County Community Health Needs Assessment indicated that 30% of the population performed some gardening activities, and 42% supported community, neighborhood, and school gardens as a healthy eating strategy.⁴⁹ Watauga County has an active county Cooperative Extension Service providing many garden and farm instructional programs.

Leola Street Community Garden was chosen as the setting for the HEN Garden Lab Program. The garden is well situated in a highly visible location, approximately 1.4 miles

from campus, with parking and bus line transportation access available. At the time of this program, this garden had been established for 10 years, with 35 personal plots available for rent by community members, and was open to the public. Garden policies stated that all foods must follow organic growing practices, and that all members were required to volunteer time to help take care of the communal garden areas. The garden site had existing garden resources available including experienced gardeners, established garden plots, tools, water, compost, and mulch. In this mountainous climate zone 6b, the growing season is short, and summer is the peak production time for local growers.

Furthermore, the garden manager was available to offer informational support to the program as well as to provide approval for the use of the garden space for gardening and classes. Leola Street Community Garden donated a large plot rental of approximately 20 x 30 feet for the educational garden program. Also, the community garden manger became a key stakeholder for the program, donated the plot, and helped to connect the researchers to community garden networks in the region.

Participants & Recruitment

The priority population for the garden program was undergraduate students with a declared major in Nutrition and Foods from Appalachian State University. A purposive sampling technique was used to recruit participants for the pilot year of the program. This sampling technique is commonly used in qualitative research, and it is useful to get a deeper understanding of the population of interest.⁵⁰ A total of fifteen (n = 15) undergraduate Nutrition and Dietetic students were recruited during May 2015. Recruitment occurred through fliers, social media, word of mouth, advertising through the Appalachian Student Dietetic Association, and verbal announcements in nutrition courses. Inclusion criteria for

participation in the study included: 1) over the age of 18, 2) a declared Nutrition and Foods Major with a concentration in Dietetics, and 3) little to no prior garden experience.

Participants were given a small incentive at the end of the study including tangible gardening items like gardening gloves, seeds, and \$20 cash. This study was approved by the Institutional Review Board at Appalachian State University.

Study Design

A mixed-methods CBPR design to describe the process and key strategies involved in implementation of the garden-based service learning program. CPBR is a form of action research that involves the community stakeholders in all steps of the research process.^{34,41} A process evaluation was used to analyze the garden education program, CBPR stakeholder collaboration, and identification of the steps required in the creation of this program. This is a method that was used to test if the program was performed as it was intended to, and to provide a measure of the quality of overall program implementation.⁵¹ The process evaluation was measured using a logic model (Appendix A) to measure inputs, outputs and outcomes of the HEN Garden Lab program.

As part of the CBPR methodology, a diverse campus-community collaboration was formed with local stakeholders. Representatives were included from across the sectors of education, food systems and health. These members included: Watauga County Cooperative Extension Office, Leola Street Community Garden, Lettuce Learn, the Hospitality House, and the Department of Nutrition and Health Care Management from Appalachian State University. These stakeholders were involved in all phases of the study from planning the program, to implementation and program evaluation; the results of the study were shared with all partners.

Data Collection and Analysis

Multiple formative methods were used to measure the process of developing the garden intervention, campus-community collaboration, and the inputs utilized. The process evaluation for this study involved four primary methods: 1) semi-structured interviews of participants upon completion of the program, 2) ground truthing, 3) document review, and 4) pre-and post-questionnaire. Table 1 presents an outline of the three primary data collection methods for the process evaluation.

Table 1. Summary of Data Collection Methods

Data Collection Methods	Examples
1) Semi-structured interviews	<ul style="list-style-type: none"> • Interviews with the participants upon completion of the gardening program • Interviews of leadership team members at the end of the program
2) Ground Truthing, including: <ul style="list-style-type: none"> • Record Keeping • Observations • Field Notes 	<ul style="list-style-type: none"> • Visiting the garden, participating in gardening activities, and observation of operation • Photographs • Garden Lessons logistics and observations • Attendance tracking • Service Learning Event Observation • Attendance of Organic Gardening Training through Cooperative Extension’s Organic 101 class • Wrap-up meetings after lessons • Conversations with gardeners, community partners and participants
3) Document Review	<ul style="list-style-type: none"> • Review of program email communication and promotional emails • Meeting minutes from community collaboration planning meetings with Cooperative Extension

	<ul style="list-style-type: none"> • Observation of foods produced in the garden
4) Pre/Post-Questionnaire	<ul style="list-style-type: none"> • Data collected at baseline, and at 5-weeks at the end of the program • Collected information on participant demographic information, food procurement and shopping behaviors, basic garden literacy, and gardening attitudes, behaviors and beliefs

Semi-Structured Interviews

Semi-structured interviews of participants and leadership team members were performed at the end of the garden program. The purpose of these interviews was to gather information on the barriers and benefits of the program. Further, the interviews were used to build recommendations for the sustainability of the program and collect viewpoints on the impact of the program on the individuals and on the community. The interview guide was divided into the following topics: 1) personal motivations for participation in the program, 2) perceived program barriers and/or other factors that limited the success of the HEN Garden Lab, 3) recommendations for future programs, 4) key success factors in programmatic operation and program, and 5) participant viewpoints on the social, environmental or health related outcomes of the program.

Program participants and one volunteer staff member were interviewed at the end of the five-week HEN Garden Lab program in August and September 2015. A total of three participants dropped out of the program in the first two weeks. Informal conversations with these participants revealed that they stopped attending the program due to time constraints related to heavy course work from summer school classes and stressful work schedules. Most of the interviews were performed on ASU's campus, except for one telephone interview.

Interviews lasted approximately 24 minutes in length. During each interview, informed consent was obtained from the participants and interviews were audio-recorded.

The semi-structured interviews were transcribed verbatim by two trained research assistants. These researchers then coded the raw data using the constant comparative method. The constant comparative technique is a systematic analysis method that begins with unprocessed data and ends with a plausible theory.⁷ Coding was done by hand on the printed transcripts, and data were identified and categorized into themes as they emerged. The findings were reviewed by a third researcher and each theme was discussed until a consensus was reached among all three coders.

Ground Truthing, Record Keeping, and Participant Questionnaire

Ground truthing is a deductive research strategy that involves the comprehensive collection of field observations.⁵² This technique has been applied to many disciplines from the development of simulation technology to low-income food insecurity research.^{52,53} Direct observation of the garden lessons was performed during each of the ten gardening classes for approximately four hours per week. The lead researchers and research assistant tracked observations including weather and other barriers that occurred during the classes. In addition, photos were taken throughout the program to develop a visual record of field observations. Attendance of all participants was tracked using a class sign-in sheet that was passed out at the beginning of each garden lesson. This attendance data was transferred to an Excel spreadsheet at the end of the season.

To capture basic sociodemographic information as well as level of garden knowledge/self-efficacy, career goals, and garden program expectations, a pre-and post-questionnaire was given to participants at baseline and at the end of the program. At the time

of this study, there were no validated instruments to measure garden knowledge, attitudes, behaviors, beliefs, or gardening self-efficacy among our priority population of students in Higher Education. Therefore, an instrument was developed and tested with our pilot program sample of 12 students.

The questionnaire was composed of 69 questions, and four sections, including: demographic information; food procurement and shopping behaviors; basic garden literacy; and gardening attitudes, behaviors and beliefs. This questionnaire included basic categorical questions, and self-efficacy scale questions ranging from 1 (not confident at all) to 10 (very confident) which were applied to topics in community nutrition practices from gardening, cooking, teaching, to sustainability. Section two included matrix style questions which prompted participants to write short answer responses in a table format regarding shopping frequency, transportation, common foods purchased, and common spending behaviors. The remaining sections utilized multiple choice format questions and 5-point scaled questions: ranging from 1 (not at all) to 5 (yes, all the time). An example questions was, “Do you think gardening will encourage people to eat more fruits/vegetables?” As well, two short answer questions were included that were transcribed and coded for themes. These included, “What are your short-term career goals?”; “What are the main things you hope to learn by participating in this class?” Quantitative data from the pre-and post-questionnaire were coded and inputted into Excel. Descriptive statistics were calculated to determine the means, standard deviations and frequencies to create a socio-demographic profile of the sample. The results of the questionnaire related to garden knowledge were not within the scope of this paper and were not included in this report. However, results from the post-questionnaire related to the process evaluation and program implementation are reported.

Results

Key Inputs and Strategies of Establishing a Garden-Based Service Learning Program

The data collected through the semi-structured interviews, field observations, document review, and pre- and post-questionnaires identified the key inputs and processes in creating the intervention. These included: 1) building community partnerships with stakeholders, 2) planning of generalized program logistics including obtaining funding and material support for the program, 3) selecting a garden location and physical land development, 4) development of a garden curriculum, 5) marketing the program and recruitment of students within the Nutrition and Foods major, and 6) identifying and training of support staff.

Building Community Partnerships with Stakeholders

One of the primary components to this program was the development of strategic campus-community partnerships. The researchers worked to build networks within existing gardening resources and educators. The Watauga County Cooperative Extension Office emerged as a key stakeholder in both the planning and implementation phases of this project. They provided guidance, resources, community connections, and insight into the process of developing garden-related experiential programs. Also, two Extension Agent educators co-taught the garden classes for program participants providing expert-level horticulture knowledge.

In addition, existing educational gardens and farms in the region became important stakeholders. Relationships and communication were developed with a variety of programs, including a homeless shelter garden, a faith-based community garden, a community garden targeting individuals and families, and a small-scale diversified local farm. Representatives

from these programs provided knowledge, support, and led tours of their respective operations. These community partnerships were intrinsic to the overall success of the program.

Planning, General Program Logistics, Funding, and Material Support

The planning process for the garden began through weekly discussion among the researchers approximately six months prior to the program start date. This process included attending tours of local community gardens and local garden-related public meetings/events, contacting potential stakeholders, writing grants for funding, and gaining university research approval.

The garden classes took place on consecutive Tuesday and Wednesday evenings from 5-7 pm for five weeks through July-August 2015. The program culminated in a total of ten classes, two field trips, and 20 hours of gardening exposure. This program schedule was chosen to align with Summer Session II classes offered by Appalachian State University. Many of the students were concurrently taking classes for the summer, and the evening timing made it convenient for both students and Cooperative Extension Agent educators to participate. Also, the garden was open to all community members during this time, which provided opportunities for students to observe community gardeners as they worked in their plots and demonstrated a wide range of gardening backgrounds and experience level.

This pilot study was funded through the 2015 Creating a Healthy, Just and Sustainable Society grant through the Office of Student Research at Appalachian State University for \$500. These funds were used to purchase program materials such as garden tools, soil amendments, seeds, an outdoor tent and table, dry-erase boards and digital cameras, as well as to offer tangible incentives to the participants. The incentives included

\$25 cash, and a small gardening toolkit (valued at approximately \$8.00), which included garden gloves, hand-tools, and seed packets. The total estimated incentive per participant is valued at \$33.00.

Garden Location Selection and Physical Development

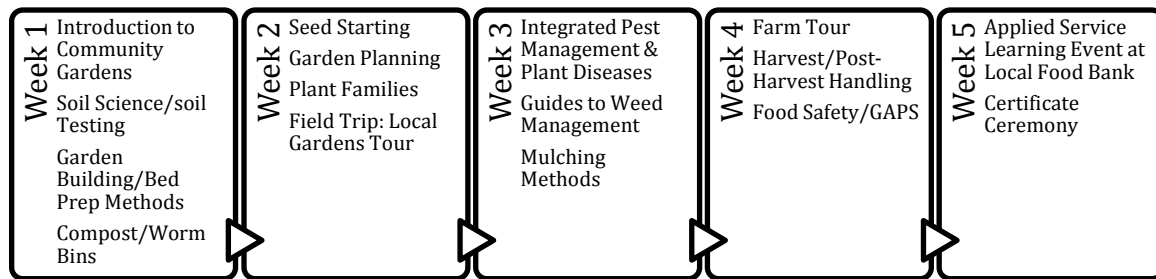
The Leola Street Community Garden was chosen as the setting for this garden program. This community garden is located approximately 1.4 miles from Appalachian State University, in a mixed suburban setting with apartments, housing, and commercial stores located within 0.5 miles. The garden was easily accessible with public transportation and parking was available on-site. In addition, there were existing communal orchard, herb and perennials gardens on-site that were used in garden classes and demonstrations. In Watauga County, there are on average 161 frost-free days/year¹, and an elevation of 3437 feet², which guided the selection of appropriate produce varieties grown in the garden plot. This setting provided access to hundreds of plants; including many common F/V, such as: kale, collards, cabbage, tomatoes, carrots, squash, beans, potatoes, swiss chard, apples and more.

Development of Garden Curriculum

A five-week curriculum in basic garden literacy was written in conjunction with the Cooperative Extension garden experts. The objectives were to include both basic gardening information and deeper scientific reasoning taught by the experts, targeted to match college-level young-adult learners. All classes were taught by two Watauga County Cooperative Extension Agents during June and July 2015 for a total of five weeks and ten classes total. Each class lasted approximately two hours in the evenings, and were held on Tuesday and Wednesday evenings. The program culminated in a ten-class series, with 20 contact hours, a farm visit, a local garden tour, and a service-learning health fair event. Lessons were

designed to have both a lecture component and a hands-on laboratory portion. Each participant received a comprehensive program binder that included the schedule, lesson plans, handouts, and additional gardening and community nutrition resources.

Figure 2. HEN Garden Lab: Curriculum Summary



Leadership development and applied community nutrition skills were emphasized throughout the classes. The program culminated in a service learning project to benefit the community. The student’s planned and led community nutrition and gardening activity stations tailored materials to a low-resource population. This multi-focal event included a meal service for clients using produce grown in the garden and hands-on nutrition and gardening activities.

Overall, our goal for the program curriculum was to link current Accreditation Council for Education in Nutrition and Dietetics (ACEND) dietetic competencies to the HEN Garden Lab. Some examples of elements we focused on included: 1) leadership skills, 2) communication, 3) diversity awareness, 4) community partnership development and 5) planning community nutrition programs. The table below provides a sample of several of the competencies and how they were attained through the HEN Garden Lab intervention.

Table 2. Sample Matrix of ASCEND Dietetic and HEN Garden Lab Curriculum

ASCEND Competency	HEN Garden Lab
I. GENERAL COMPETENCIES	
1) Participate effectively in individual and group problem-solving processes	<ul style="list-style-type: none"> Working in small groups, prepare planting trays, seed assigned crop and develop a mini seed planting demonstration for the class
2) Demonstrate positive and cooperative working relationships with associates	<ul style="list-style-type: none"> Communicate effectively among associate team members during planning, and implementation of serving learning health fair activity station
II. COMPETENCIES FOR DIETETICS CONCENTRATION	
1) Demonstrate effective and professional oral and written communication and documentation and use of current information technologies when communicating with individuals, groups and the public	<ul style="list-style-type: none"> Lead Health Fair participants through applied community nutrition activity station working in a small group
2) Identify and describe the roles of others with whom the Registered Dietitian collaborates in the delivery of food and nutrition services	<ul style="list-style-type: none"> Participate in a tour of the local community gardens, and participate in class discussion about community stakeholders
3) Apply knowledge of the roles of environment, food, and lifestyle choices to develop interventions to effect change and enhance wellness in diverse individuals and groups	<ul style="list-style-type: none"> Read assigned community needs assessment on the status of food environmental barriers in Watauga County and participate in class discussion
4) Develop an educational session or program/educational strategy for a target population	<ul style="list-style-type: none"> Plan and present a nutrition education activity tailored to a low-resource transitional/homeless population in small groups

Program Marketing and Recruitment of Students

Several marketing strategies were used to promote the garden program for the target population of undergraduate nutrition and dietetic students. Recruitment fliers were developed and posted in both the department building and online through social media

outlets commonly used by the students, such as Facebook. For example, permission was granted to post the recruitment flyer on the Facebook page for the student-led Dietetic Association Club membership. Additionally, the program was marketed verbally to students during a brief announcement in core curriculum classes for nutrition and dietetic students, including Community Nutrition and Basic Food Science. Interested students were asked to sign up to attend an orientation session at the garden where more information on the program was distributed.

Figure 3. Participant Recruitment Flier



You are receiving this email because you have indicated you may want to participate in the HEN Garden Lab Research Project. Thank you for your interest!

Research Participants Needed

Volunteers Needed for HEN Garden Lab Study

Researchers in the Department of Nutrition & Dietetics are seeking volunteers to participate in a study to determine the effects of an experiential garden education program on community nutrition education interventions. This study has been approved by the ASU IRB (study #15-0274).

If you are healthy, between the ages of 18-30, a declared nutrition major, have no previous garden education, and are available during the 5 weeks of Summer Session Two (July 1 - August 8th), you may be eligible. Enrollment in the study would require participation and attendance in the 5 week study, that will meet approximately 4 hours / week - spread over two class dates. Research participants will receive free garden education, and a garden supply kit upon successful completion of the program.

Please log on to the doodle poll below to indicate the dates/ times that would be best for your schedule.

<http://doodle.com/ez9b9ggnqvwx624e>

In addition, a weekly newsletter was developed and communicated to students during the 5-week class series. This newsletter was used to remind students of upcoming classes, logistics, assigned readings, and to notify them of any weather-related schedule changes and current events related to curriculum topics.

Identifying and Training of Support Staff

A highly-motivated team of support staff volunteers was essential to the smooth operation of the program implementation. All positions were volunteer based and provided the incentive of leadership training and experience in research and community programs development.

A nutrition graduate student performed the role of garden manager for the program and co-assisted with the project's research. This student came to the project with previous experience in managing educational gardens, a background in farming, and experience working with diverse community stakeholders including the Cooperative Extension Office, AmeriCorps and community gardens. The garden manager was responsible for planning and managing the garden production before and during the classes to ensure that a wide variety of common F&V plants were available during the class sessions.

In addition, two undergraduate students from Appalachian State University were recruited for the leadership support staff team, including a research assistant and a field agricultural teaching assistant. The research assistant was trained by the lead researcher and supported the program in collecting field notes, performing administrative tasks, managing attendance, and supporting with the research collection and analysis. Further, the research assistant provided vital peer-to-peer communication with the participants. This position was responsible for sending out a weekly newsletter of program updates, communicating

schedule changes, answering and directing questions, and providing reminders of class dates, project assignments, and more. The field agricultural teaching assistant was a student majoring in Sustainable Agriculture and acted as a bridge between the department of Nutrition and Health Care Management, and the department of Sustainable Development. This person was responsible for helping assist the garden manager and Extension Agent Educators with lesson planning, garden maintenance, teaching activities, class setup, and cleanup at the close of each class. The teaching assistant was chosen for experience as an educator and familiarity with the setting as she was also a resident member of the community garden.

Program Outcomes & Recommendations for the Future

The framework of a logic model was used to analyze the primary results from the pilot season of the HEN Garden Lab program (Appendix A). The outcomes were segmented into short and mid-term categories. These included: 1) the creation of a novel garden-literacy program that included 20 hours of hands-on garden experiences, a certificate, a garden resource toolkit, and incentives for participants; 2) increased campus-community partnerships and collaboration among stakeholders, local garden experts, and University students/staff; 3) increased social networking among ASU undergraduate nutrition students; 4) increased civic engagement to improve F&V consumption in underserved community groups; 5) improved awareness of gardening applications to dietetic practice; and 6) increased student support for locally grown products and self-reported F&V intake.

Overall, the project succeeded in meeting the initial research objective to establish and describe the garden education program. The results from the interviews measured programmatic success variables as rated by the participants. For example, the question, “On a

scale of one to ten, (with 1 meaning a “complete failure” and 10 meaning “a total success”), how would you rate the overall success of the program?” was assessed. The average score was 8.79, with scores ranging from 6 to 10. A similar scale was used for the question, “How would you rate your experience in the program?” The results identified an average score of 8.08, with scores ranging from 6.5 to 10. One student stated, “I enjoyed it thoroughly, (*it was*) one of the best parts of my summer.”

The results from the inductive analysis of the interviews revealed several key themes spanning from the individual to the community level. These included topics such as benefits of the program, recommendations for the future, and impacts of the program on students’ future careers. Examples of participant quotes are visualized in Table 3 below.

Table 3. Sample Interview responses from participants related to key thematic areas.

<p>I. INDIVIDUAL</p> <ul style="list-style-type: none"> • "I definitely wanted to try more, umm vegetables, just straight out of the garden. And I've noticed that it's influenced my shopping now, I'm buying more vegetables." • "I never thought before about like, how the nutrients in the soil affect the nutrients in the food. (...) It's just made me think a lot more about how the growing method from the seed to the soil to everything affects the final food and the nutrient content."
<p>II. INTERPERSONAL</p> <ul style="list-style-type: none"> • “I didn’t know a ton of people in my program prior to (...) doing the research project, so that was really cool to get to know people outside of a school setting and on more of a personal basis.” • "I think it (gardening is an) economical option so I wanted to learn about it so that I could umm like be able to give people that tool. Once I learn those skills (gardening) to be able to teach it to other people too."
<p>III. ORGANIZATIONAL</p> <ul style="list-style-type: none"> • "I think it can definitely like increase fruit and vegetable intake if people learn about gardening and how things are grown and grow it yourself. Like if you grow something yourself, you are not just going to let it sit there and rot on the vine."

<ul style="list-style-type: none"> • “I was unaware of the exact resources provided by the extension office that are available which was really cool to see.”
<p>IV. COMMUNITY</p> <ul style="list-style-type: none"> • "I think about urban farming (...) and gardening and (...) community health initiative that have (...) taken people who are high risk for (...) diabetes or heart disease (...) and using gardening (...) as a cultural tool to you know get them more interested in fresh food (...)." • "I'm very interested in food insecurity and homelessness, (...) I think that gardening will be a good skill to (...) provide to people in that kind of setting, um along with all the other life skills they are learning. (...) I think that it will help people to know if they can grow some of their own food, then that's money that they are not having to spend at the grocery store."
<p>V. POLICY</p> <ul style="list-style-type: none"> • "No matter who my audience is, gardening is going to pay a big impact with my clients. I think policies, (like) regulating community gardens and stuff could be a really big thing just because a lot of people are food insecure and stuff, and it'll be easier to get people the amounts of fruits and veggies that they need." • "<i>(I learned)</i> the importance and role of community in getting something like a garden (...) off the ground. How it just takes a lot of volunteers (...) to get something like that to work."

In this cohort, the researchers observed low levels of baseline gardening knowledge and gardening self-efficacy measures. Average perceived knowledge of sustainability/gardening among the participants was 3.87/10 (SD=2.59). Through the interviews, one participant stated, “*(the program)* made me a lot less scared of (...) starting a garden you know (...) it was always kind of intimidating before and now I feel like I have enough basic knowledge that I don’t have to be intimidated by gardening.”

On an individual level, the participants reported an increased sense of civic engagement and improved social connections to their fellow students through participation in the program. In addition, students perceived that participation in the program would positively impact their future careers. For example, one student stated, “I feel like it would be a helpful asset if I end up becoming an RD one day, or (...) working in that kind of setting,

where I could utilize those skills to ... help people eat healthier.” Other students described potential gardening applications to diverse community nutrition settings and populations including WIC, elementary education, community health initiatives, chronic disease patients, and low income populations. Some students reported changes to their personal eating habits including increased F&V consumption and local foods buying behaviors.

The participant interviews provided insightful recommendations on methods to improve the program for the future. In response to the question, “What changes might you recommend for the next HEN Garden Lab program?”, several primary themes emerged. These included: 1) extend the length of the program, 2) steer the curriculum toward entry-level gardening information with more guest speakers, and 3) provide increased hands-on time in the garden. Half of the students discussed a desire to extend the length of the program, such as one student who stated, “I think it would be cool if it was a longer program,” and another who said, “I would personally make it a little longer and break up the lessons a little bit more.” Other barriers observed during the program were the noisy roadside garden setting, a need for a structured outdoor classroom with seating, and rainy-day shelter options. In addition, responses to the curriculum were mixed within the cohort. The interviews revealed who felt that the classes should be more basic and those who really enjoyed the current Extension Service curriculum depth. For example, while one student stated, “I did get a little like overwhelmed sometimes (...) there’s so much to learn I guess.” Other students said, “I thought it was going to be basic, but they went into the scientific reasoning, (...) I thought that was awesome. It was definitely more than I was expecting.” Several participants recommended strategies such as: adding in a volunteer requirement, extending the class length, performing vegetable taste tests, and dividing the classes into

lectures and separate hand-on garden time. Increasing the program length could allow for the addition of more guest speakers and for facilitators to break down the concepts in smaller units. This could allow for more time to explore each concept, to increase comprehension, and to build self-efficacy for applying these skills in future practice.

Discussion

CBPR has been recommended previously in the literature as a potential strategy to be applied to garden-based intervention projects.³⁴ CBPR is a unique style of research that is known for the active involvement of the community participants in all aspects of the research design and implementation.^{34,41} The CBPR action research framework was an appropriate match for the HEN Garden Lab. The model maximized relationships and network building among existing community associations and institutions. This resulted in a program that was both tailored to the unique needs of this community, and one that could be individualized to match similar communities across the country.

The findings from this study are consistent with those in the literature. In 2012, one of the first known community garden interventions to utilize the CBPR methodology was performed. The researchers and community, actively worked together throughout the study - first, through a series of four workshops with a diverse committee of community stakeholders (n = 28). Secondary benefits of the use of the CBPR model in this study were enhanced campus-community ties and trust, and a greater insight into community values and priorities.³⁴

A 2011 survey of dietetic program educators identified the extent that sustainability concepts were currently incorporated within dietetic programs. This survey used Linkert

scales to measure the relative importance allocated to sustainability topics, educator attitudes, and resource gaps with incorporating these topics within dietetic programs. From the 145 educators who responded, 68% indicated that they were interested in the topic, and 77% wanted more resources on ways to incorporate these topics within their curriculums. Yet, only 42% of these educators felt confident in teaching these topics. This study identified that educators would benefit from support with curriculum development, applied project ideas, classroom discussion topics, and reading lists. In this study, sustainability principles were currently applied most often to topics including: community nutrition, food insecurity, GMOs, produce seasonality, food safety, and water issues.⁵⁴

There are only a few similar studies targeting gardening, service learning and dietetic students available in the literature. In one 2010 study, a garden-based service learning initiative of dietetic students in Texas participated in a 6-week basic garden literacy course at a local community garden. Much like the present study, this study emphasized service learning in the community setting, particularly in places focused on improving food security and linked garden literacy curriculum to ACEND competencies.³⁹ Similarly, Cooperative Extension was a common stakeholder within both programs – with Master Gardeners teaching the training course in the Texas study, and Extension Agents in the HEN Garden Lab Program. The target populations were slightly different among these studies, with the Texas garden intervention program targeting Dietetic Internship students, and the HEN Garden Lab program serving undergraduate Nutrition and Dietetic students. Additionally, long-term outcomes for student’s participation in gardening programs is an area for future research. There is limited evidence in the literature regarding these long-term outcomes. In the Texas garden intervention study, the garden program was initiated in 2007, and from the

first three years of data collection, the researchers noted that participants had a wider understanding of their role as health professionals within the greater social and environmental contexts.³⁹

The HEN Garden Lab program was tailored to a population of only Nutrition and Dietetic students. However, in a study from Ohio, the ECOhio Garden Project, was open to a wider cohort of participants, including high-school students, dietetic students, various community members and social service directors from pre-schools to senior centers. As well, this study included a unique education model, as the researchers created a half-day workshop with a diverse range of guest speakers including master gardeners, university faculty, volunteers and community leaders.⁴⁰ There is very little published research regarding the use of gardens, and/or community gardens within collegiate education. Of the few studies that exist, educators within the fields of agriculture, education, and environmental studies have performed them. More information is needed to determine effectiveness of programs open to the wider university and general community, or those closed to dietetic and nutrition students.

A limitation of this study was potential researcher bias as the program coordinator conducted the semi-structured interviews with participants. This may have affected the results as the students were familiar with the interviewer. Further, the recruitment process utilized convenience sampling methodology. While this technique is normative within qualitative research design, it provides a potential reduced generalizability to the public. In addition, the study could have been improved through by the addition of both instructor and community stakeholder interviews.

This study adds to the literature by describing the process of implementing a garden literacy and service-learning program, nested within a rural, Appalachian setting. Results from the 2015 Watauga County Community Health Needs Assessment indicated that 30% of the population performed some gardening activities, and 42% supported community, neighborhood, and school gardens as a healthy eating strategy.⁴⁹ Gardening interventions in this rural Appalachian setting may be a culturally competent and effective strategy to help improve F&V consumption within this population. Also, this study design utilized garden experts from Cooperative Extension to provide the teaching for the program, both improving the quality of instruction and building community partnerships.

This topic is important because Registered Dietitians are recognized as the food experts. They often provide leadership for interventions to improve F&V consumption among Americans. A deficient in the current curriculum training for accredited Nutrition and Dietetic programs related to gardening and food production, may be contributing to a growing knowledge gap among students.

On a community level, improved community cohesion has become a component in the development of a long-term garden program sustainability plan. The results from the field observations and participant interviews identified recommendations on ways to improve the program for the future. The students noted that the current garden setting was noisy due to the road-side location, and there was need for improved outdoor classroom infrastructure with benches, restrooms and a rainy-day shelter or classroom. As well, the students described a preference for peer-based education compared to expert-led education. In the interviews, they encouraged more hands-on learning and boiled down topics for future cohorts. From these recommendations, the researchers identified potential future garden sites, and initiated

discussions and collaborations with additional community garden organizations. This led to the development of a co-management relationship with a current pre-school garden for the future of the HEN Garden Lab program. This school had an existing outdoor classroom, was open-year-round, and provided an opportunity to directly apply gardening principles with preschoolers, parents, and the wider school community of educators, volunteers and their respective networks. The data collected and presented in this report was from the pilot year of the program. The HEN Garden Lab program has continued to grow and is now entering the third year of programming.

Conclusions and Implications

Despite these limitations, this study adds to the literature by addressing the current knowledge gap related to the use of gardens within university education, and specifically within nutrition and dietetic programs. The findings from the logic model and the interviews support the overall success of the HEN Garden Lab program, and the accomplishment of the program's primary objectives. The CBPR research framework was an appropriate approach for this topic, as the theory achieved active participation of multiple community stakeholders and the open sharing of ideas and resources. However, research in this area is very limited, and more research is needed on this topic. Some areas for future investigation include: long-term outcomes of participation in a garden literacy program upon future career applications, individual and community-level improved F&V consumption, gardening and local purchasing behaviors, and increased relationships and civic engagement between participants and community networks.

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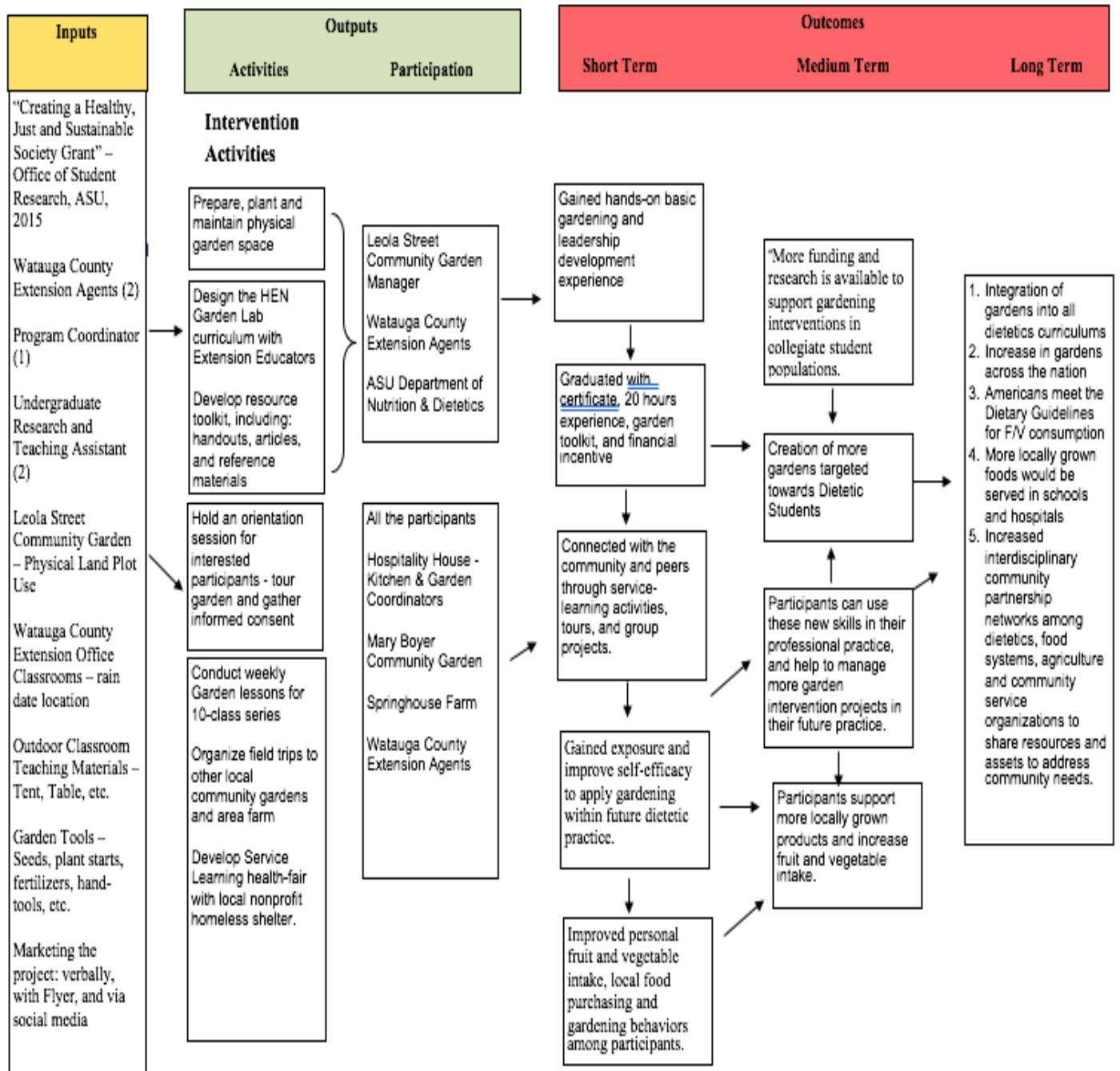
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APPENDIX A



LOGIC MODEL

APPENDIX B
CONSENT FORM

Consent to Participate in Research
Information to Consider about this Research

Hunger & Environmental Nutrition (HEN) Garden Lab
Principal Investigator: Margaret Gartman
Department: Nutrition & Dietetics
Contact Information: gartmanmg@appstate.email.edu
[include name/contact for faculty advisor if PI is a student]: Dr. Lanae Ball
ballkl@appstate.edu
[If research is externally funded] This research is funded by:
Office of Student Research - Appalachian State

What is the purpose of this research?

The overall goal of this project is to connect undergraduate nutrition and dietetic students to a sustainable gardening project by implementing a garden literacy program at the Leola Street Community Garden. This project will provide hands-on service learning opportunities in gardening, sustainability, and food systems. We hope to share the results of this study through publishing a research paper on the findings, and it will culminate in a Master's Thesis.

Why am I being invited to take part in this research? Are there reasons I should not take part in this research?

If you decide to volunteer to participate in this study, you will be one of 15 students to do so. To be eligible for this study, you must be a student at Appalachian State University, with a confirmed major in Nutrition and Foods. You must be at least 18 years old to participate in this study and should have none to very basic prior gardening experiences/exposure.

The study will be conducted during 5 weeks of Summer Session 2 (July-August). To be apart of this study, you will be required to attend and participate in all bi-weekly meetings. Participation will require active involvement, and you will be working outside. If you have any prior health conditions that may prevent you from performing active garden tasks - from lifting, squatting, bending, pulling, etc. you may not want to participate in this study.

What will I be asked to do?

This study will require attendance at the 10 bi-weekly gardening classes, which will be held through Summer Session II. Each class will run for approximately 2 hours, and total study involvement would require a time commitment of at least 20 - 22 hours over the course of the study. The research and classes will be held primarily at our garden site: Leola Street Community Garden, Boone, NC. However, some classes will be held at field-trip locations and may require travel -- car pooling will be arranged for travel days.

If you agree to participate in the study, you will be asked to complete a pre-study screening questionnaire, and then a post-study screening questionnaire at the end of the program. As well, at the end of the study, you will be asked to participate in an interview that will be recorded using an audio-recording device. These interviews will take place in the Nutrition Building, at Appalachian State University.

Photos will be taken by the research team during the course of the project, and a photo release form will be required for all participants. These photos will mainly be taken to document the process of developing and maintaining the garden. Further, participants will be required to take a photo diary of their experiences, and to submit these at the end of the project. Cameras (either digital or disposable) will be provided to each participant to use over the course of the project. Participants will be instructed to download the photos into an ASU Learn site and create a photo diary that describes their experiences using the technique of photovoice. A photovoice training will be provided at the orientation session before the project begins. The research team will be responsible for printing or film development. Some of the photos will be displayed at the last garden meeting. However, participants should not post any photos on social media sites such as Facebook, Instagram, Twitter, etc.

What are possible harms or discomforts that I might experience during the research?

The level of risk of this research is minimal risk. This means that to the best of our abilities, the risk of harm and discomfort from participating in this study would be no more than that which you might encounter in activities of daily living.

You may find some of the garden class days to be uncomfortable due to weather or active outside manual labor. If so, you are encouraged to bring water and snacks, and proper clothing for weather conditions. We will have water on site, and will encourage you to take breaks and adapt any behaviors that are causing you discomfort.

Are there any reasons you might remove me from the research?

There may be reasons where we will need to remove you from the study, even if you want to stay in. These include: lack of attendance or participation in course programming, and disruptive or disrespectful behavior to other course participants, teachers, or field leaders. If we find that we need to remove you from the study, you will be asked to drop out, and will no longer be able to attend HEN Garden Lab classes, nor will you receive the certificate of completion.

What are possible benefits of this research?

By participation in this research, you may benefit by gaining knowledge and first hand experience in organic gardening techniques. As well, you may benefit by working physically outside, by building networks of garden educators in our community, also as with other Nutrition students. Participation in this research will provide the benefit of leadership development in fruit/vegetable community nutrition programming, and you will leave with a resource binder toolkit, further as primary field experience.

This research should help us learn more about Field-Based Gardening programs as a learning environment for community nutrition programs, especially in rural communities.

Will I be paid for taking part in the research?

You will not be paid for your participation in this study nor will you receive academic credit for you participation. However, you can earn ASDA hours for participation. As well, you will leave with a certification of completion in the HEN Garden Lab program, and have first hand experience to add to your resume. Finally, participants that successfully complete this program will receive a garden education toolkit to take with them into future nutrition education endeavors.

What will it cost me to take part in this research?

It will not cost you any money to be part of the research. However, you may need to provide transportation to the garden, and field sites. As well, you will be asked to bring appropriate garden clothing and water to each field day.

How will you keep my private information confidential?

Full efforts will be made to maintain confidentiality of all data and information collected through this study. To do so, participants names will be replaced with a numeric code. Your information will not be identifiable in any future publications. The information that you provide to us will be kept in a protected storage location in LS Dougherty from Summer 2016 to Summer 2019. If you agree to sign this consent form, you acknowledge that photos maybe taken during the study and used in the scientific process.

Whom can I contact if I have a question?

If you have questions about your rights as someone taking part in research, you may contact Dr. Ball at 828-262-2983 ballkl@appstate.edu or contact the Appalachian Institutional Review Board Administrator at 828-262-2692 (days), through email at irb@appstate.edu or at Appalachian State University, Office of Research Protections, IRB Administrator, Boone, NC 28608.

Do I have to participate?

If you decide to take part in this research study, your participation is entirely voluntary. If you decide to withdraw from the study, there is no consequence. You may decide at any point in time that you no longer want to participate in this study. Your participation in this project will in no way impact your standing in the Department of Nutrition, including your coursework and activities with the Appalachian Student Dietetic Association.

This research project has been approved on _____(date) by the Institutional Review Board (IRB) at Appalachian State University. This approval will expire on [Expiration Date] unless the IRB renews the approval of this research.

I have decided I want to take part in this research. What should I do now?

If you have read this form, had the opportunity to ask questions about the research and received satisfactory answers, and want to participate, then sign the consent form and keep a copy for your records.

Participant's Name (PRINT)	Signature	Date
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Photography and Video Recording Authorization

With your permission, still pictures (photos) and/or video recordings taken during the study may be used in research presentations of the research findings. Please indicate whether you agree to having photos or videos used in research presentations by reviewing the authorization below and signing if you agree.

Authorization

I hereby release, discharge and agree to save harmless Appalachian State University, its successors, assigns, officers, employees or agents, any person(s) or corporation(s) for whom it might be acting, and any firm publishing and/or distributing any photograph or video footage produced as part of this research, in whole or in part, as a finished product, from and against any liability as a result of any distortion, blurring, alteration, visual or auditory illusion, or use in composite form, either intentionally or otherwise, that may occur or be produced in the recording, processing, reproduction, publication or distribution of any photograph, videotape, or interview, even should the same subject me to ridicule, scandal, reproach, scorn or indignity. I hereby agree that the photographs and video footage may be used under the conditions stated herein without blurring my identifying characteristics.

Participant's Name (PRINT)	Signature	Date
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APPENDIX C

INTERVIEW GUIDE

Interview No:	Name of Interviewer:
ID:	
Date:	
Start Time:	Stop Time:

HEN Garden Lab
Participant Interview

“Today I will be recording this interview. Everything you say will be confidential.”

Turn on RECORDER

“We are here to talk about your experiences in the HEN Garden Lab:”

I. Personal reasons in Participating in HEN Garden Lab

- Leading question: why did you want to participate?

1. Why did you choose to study nutrition?
2. Do you grow any of your own food?
3. Did anyone in your family grow their own food?
4. Do you go to the farmer’s market or other locations that sell local produce?
5. Did you know the garden was organic before you started the program?

6. How do you think it will help your career in nutrition and dietetics?
7. How did you first hear about the HEN Garden Lab project?
8. In your own words, what is the primary purpose of the HEN Garden Lab?
9. What did you hope to learn in the HEN Garden Lab Program?
10. How confident did you feel at the beginning of the program that you could grow your own food?
11. How did your own personal eating habits change throughout the course of the program?

II. Perceived Program Barriers

1. Did you experience any constraints that made it hard to participate in the HEN Garden Lab?
 - a. Probes: School? Work? Travel? Amount of time required? Activity Level? Instructors/Staff?
2. Were you able to participate in all the HEN Garden Lab activities / lessons that you wanted to? If not, why?

3. What could the program organizers do to help you learn better?
4. How do you feel about using gardening to teach nutrition programs?
5. Do you think learning about food production gave you a new understanding of food and health?
6. How could you use the gardening lessons in your future career?

III. Recommendations

- Leading question: I. Has the HEN Garden Lab met your expectations and or needs? Why?
 1. A. What changes do you recommend for the next HEN garden Lab program?
 - a. Probe: Did you feel that you had enough time in the garden?
 2. Did you feel that lessons were helpful in learning basic gardening concepts?
 - favorite lesson?
 3. **Probe: What about the instructors?**
 4. Do you think the HEN Garden Lab should be offered only to students in nutrition and dietetics? Why or why not?
 5. Did you think the current level of resources (funding, staff, tools) was adequate for the programs goals?

6. On a scale of 1 to 10 (1 being a complete failure and 10 being a total success) how would you rate your experience in the HEN Garden Lab?

a. Probe: Overall success of project?

IV. Success Variables

1. How confident do you feel that you could help manage a school or community garden in the future?

2. Has participation in the HEN Garden Lab helped to you make connections to organizations in the community?

a. Probe: Do you think you would like to volunteer more with them in the future?

3. Has participation in the HEN Garden Lab helped you connect more to your fellow nutrition students? If so, how?

4. Do you think you have benefited on a personal level from participation in the HEN garden lab?

5. What do you consider to be the most important lessons that you have learned from this program?

Thank you for your time. Do you have any other comments or things you would like to add at this time?

- How was the interview for you?

Vita

Margaret Grace Gartman was born in Denver, Colorado, to Howard and Dawn Gartman. She graduated from Pinecrest High School in North Carolina in May 2005. The following fall, she entered the University of North Carolina at Chapel Hill to study Exercise and Sport Science, and in May 2009 she was awarded the Bachelor of Arts degree. In the fall of 2015, she accepted a research assistantship in Nutrition at Appalachian State University and began study toward a Master of Science degree. Her M.S. and Dietetic Internship was completed in August 2017.

Miss. Gartman is a member of the Academy of Nutrition and Dietetics, and remains active in gardening and community food-system efforts. She resides in the Pacific Northwest with her boyfriend and two kittens.