College Students Educating Children and Families on Healthy Eating and Physical Activity Using an Edible Garden

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ABSTRACT. Although there are institutional barriers to interdisciplinary teaching in higher education, students report higher levels of cognitive though and greater knowledge of subject matter when they learn in interdisciplinary ways. This paper highlights interdepartmental collaboration for developing an undergraduate course integrating three concepts: child development, gardening, and nutrition. The course design is meant to prepare undergraduates for developmentally appropriate strategies to educate preschoolers on well-being through use of garden with edible crops. Forty-five students from various majors enrolled in the course over a 2.5-year period. Experiential learning activities included gardening activities at the University Child Development Laboratory along with tours of local farmers' markets, the University Farm, and the Children's Museum Edible Schoolyard. In reflective journaling, students reported on knowledge they gained in the three areas as a result of experiential gardening activities with preschoolers. The paper concludes with discussion implications of interdisciplinary course development among family science researchers and the role of gardening education in teaching health and well-being to preschoolers.

Keywords: interdisciplinary teaching, experiential learning, gardening education

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Introduction: Interdisciplinary Teaching

Teaching and learning across various subjects is a growing theme in higher education (Maxwell, 2003; Woods, 2007). Advocates for interdisciplinary teaching recognize its value in preparing college students to master problem solving skills with the ability to deal with complex societal issues upon graduation (Jacobson & Wilensky, 2006; Woods, 2007). Although interdisciplinary education is strongly encouraged in the university classroom, it often faces the challenge of bringing individuals from differing disciplinary backgrounds to work together on a shared idea or ideas.

The aim of interdisciplinary teaching is to "produce new knowledge that transcends the sum of its disciplinary parts" (Kelley-Irving et al., p. 35). Interdisciplinary teaching is viewed as a conceptual tool in shaping thinking and development within the university classroom. Student learning that crosses subject matter is an important and central theme in higher education (Spelt, Biemans, Tobi, Luning & Mulder, 2009; Woods, 2007). Proponents of interdisciplinary teaching describe its educational benefits for college students as a way to combine their disciplinary knowledge to addressing complex real world problems (Woods, 2007). Unlike multidisciplinary studies, which focuses on knowledge of different disciplines, interdisciplinary teaching is integrative, not additive. By integrating knowledge of different disciplines, interdisciplinary teaching affords faculty the opportunity of co-teaching – bridging and integrating subject matter (Spelt et al., 2009). Interdisciplinary teaching methodology acquires new and/or different teaching strategies to enhance faculty teaching effectiveness and helps expand instructional approaches, increasing opportunities for student success (Cook & Friend, 1995). Its benefits include lower student-teacher ratios, greater student participation and engagement, and easier ways for teachers to facilitate instructional strategies.

One component of interdisciplinary teaching is the process of working across disciplines to develop courses. It is suggested that course/curriculum development be completed not in isolation, but rather as part of iterative planning, development, implementation, and review (Voogt et al., 2011). Research shows that interdisciplinary education helps advance college students' critical thinking, cognitive development, and problem solving strategies (Kaur & Manan, 2013). This approach facilitates students' comprehensive understanding of subject matter. The key to effective curriculum development is ensuring students are actively engaged in their learning process and that their learning outcomes meet the objectives.

Experiential Learning

According to Girvan, Conneely, and Tangney (2016), experiential learning classifies various forms of learning, including inquiry-based and problem-based learning. John Dewey's theory of experiential learning recognizes experience and education as natural linkages during the learning process. Dewey developed an experiential curriculum that integrated gardening and cooking with mathematics, natural history, food science and economics. His experiential curriculum was an effective way for students to experience the application of science (Gordon, 2008; Ralston, 2011).

An expansion of Dewey's theory is Kolb's experiential learning model (ELT). Experiential learning strategies are often integrated in courses to improve student learning. This approach focuses on new experiences and knowledge connected with pre-existing experiences and knowledge in a continuous learning cycle (Baker, Robinson & Kolb, 2012). Moreover, experiential learning including hands-on and integrated lessons has been reported to increase students' content knowledge (Okoli & Abonyi, 2014). The ELT guides the current paper, with experiential learning centered on integration of *child development, horticulture,* and *nutrition education.*

Gardening, Nutrition Education and Young Children

Policies and programs focusing on emotional, social and physical development in young children are crucial to their healthy development later in life. In this regard, garden-based nutrition-education programs have become popular as strategies for increasing students' dietary intake of fruits and vegetables. In California in 1995, Alice Waters started the Edible Schoolyard program, providing the springboard for research on the impact of school gardens and gardening curricula (Waters, 2008). Since then, increasing numbers of schools have established on-campus gardens as part of a growing movement for "greening" schoolyards. For instance, Guilford County, North Carolina has had a significant increase in the numbers of schools with gardens in the past 10 years, from 15 in 2010 to 76 in 2017 (Palmer McIntyre, personal communication, November 30, 2017). Benefits of school gardens are numerous (Stewart, 2014). Such gardens not only provide outdoor laboratories for science, technology, engineering, and mathematics (STEM) lessons and aesthetically pleasing spaces for children to work and play, but gardens also affect students' attitudes towards school and create positive environments for improving student skills (Blair, 2009; Klemmer, Waliczek, & Zajicek, 2005). Student access to school gardens also improves overall student achievement in science (Smith & Motsenbocker, 2005).

Furthermore, gardens boost students' fruits and vegetables consumption, promoting healthier eating habits through increasing exposure to gardening and its produce, which is observable for various ages and demographics (Koch, Waliczek, & Zajicek, 2006; McAleese and Rankin, 2007; Morris, 2007). Research shows that the impact of gardening education on children has effects lasting into adulthood (Lohr & Pearson-Mims, 2005). Garden-based learning is an effective, engaging way to integrate curriculum and meet learning standards,

giving children the chance to develop a wide range of academic and social skills (Ozer, 2007). Healthy dietary behaviors such as eating a balanced, varied diet are often addressed as being beneficial in garden-based programs for young children. According to Morris, Briggs, and Zidenberg-Cherr (2000), children who plant and harvest vegetables are more willing to taste and enjoy them. When children have more choices of a variety of fruits and vegetables, they are also more likely to follow healthier diets. Similar research shows support for the likelihood that children will choose fruits or vegetables as snacks after participating in garden programs (Koch, Waliczek, and Zajicek, 2006; Lineberger & Zajicek, 2000). Incorporating gardening along with food preparation, nutrition, and physical activity is an effective way to improve children's reported vegetable intake and physical activity in after-school settings (Hermann et al., 2006). Gardens that use nutrition education programs with young children positively improve their dietary behaviors through skill enhancement and behavioral change (Parmer, Salisbury-Glennon, Shannon, & Struempler, 2003). Growing vegetables and fruits in garden programs raises children's food consciousness (Libman, 2007; Lohr & Pearson-Mims, 2005). As schools play important roles in education and promotion of healthy eating among young children (Dudley, Cotton, & Perlata, 2015), the authors believe this strategy should continue to be used and taught to students.

The authors recognize barriers in developing an interdisciplinary course to achieve that goal. Various pedagogical strategies used for overcoming those barriers were highlighted in development of the undergraduate course Family and Consumer Sciences (FCS) 423: Nutrition and Gardening Education for Young Children. The new course aligns with the University's Strategic Plan Preeminence 2020, where a top priority is "The scholarly research of faculty and collaborative efforts that engage undergraduate and graduate students will produce a stronger culture of discovery-driven learning." FCS 423's alignment with the university's strategic plan was a key to promoting students' experiential learning and their knowledge of gardening education.

This paper conceptualizes development of a team-taught course by faculty and researchers in family sciences, early childhood education, horticulture, nutrition, child development and cooperative extension.

Method

This paper is based on research supported by the United States Department of Agriculture National Institute Food Administration 1890s Teaching, Research and Extension Capacity Building Grant entitled "Educating Healthy Children: A Nutrition and Gardening Education Curriculum." Faculty from Family and Consumer Sciences and Natural Resources and Environmental Design collaborated on preparing the grant proposal. Their goal was to develop a course using gardening to educate students on the importance of nutrition and well-being education and to transfer their knowledge to preschoolers. The primary objective was to inform students on the use of age appropriate and developmentally appropriate strategies to teach

preschoolers about healthy eating and edible gardens. The project took place from Fall 2011 (i.e., the first course was offered in Fall 2012) through Spring 2015 at an Historically Black College or University (HBCU) in the southeastern United States.

Participants

Two groups participated in the study: undergraduate college students and preschoolers enrolled in the university's Child Development Laboratory (CDL). Subsequent references to undergraduate students in this study will be "students."

Students. Table 1 displays demographic information for the forty-five students enrolled in the FCS 423 course between Fall 2012 and Spring 2015.

Table 1. Students' Demographic Information n=45

Item	Characteristic	Fall 2012	Spring 2013	Spring 2014	Fall 2014	Spring 2015
Enrollment (*f*)		6	8	10	10	9
Gender	Male	---	---	1	2	1
	Female	6	8	9	8	8
Racial/Ethnicity	African American	6	7	10	9	9
	White Caucasian	---	---	---	---	---
	Hispanic/Latino	---	1	---	1	---
Classification	Freshman	1	1	1	1	---
	Sophomore	3	1	3	5	5
	Junior	1	2	3	2	3

	Senior	1	4	2	2	1
Major/Degree Program	Child Development	5	4	7	6	6
	Nursing	---	---	---	1	1
	Psychology	---	1	1	---	---
	Landscape architecture	---	1	---	1	---
	Nutrition	1	1	1	1	---
	Health sciences	---	1	1	1	2

Note. f refers to "frequency"

Preschoolers. There were four cohorts of preschoolers (n=120) who participated in the study. More than half of the preschoolers (n=90) participated in the study for two years depending on their enrollment at the CDL. Preschoolers ranged in ages from 2½ to 5 years of age. Ninety-five percent of the preschoolers were African American, with the majority (60%) being female. Socioeconomic status of preschoolers' families ranged from $30,000 to $170,000. Slightly more than half (52%) of the preschoolers' families (mothers, fathers, or both) were employees of the university where the study took place.

Procedures

In year one, the project team met weekly to share ideas and concepts from their respective disciplines to develop the course FCS 423: Nutrition and Gardening Education for Young Children. Most of the project team members, including graduate and undergraduate research assistants, were trained and certified by the Collaborative Institutional Training Initiative (CITI), an online training program that provides the conceptual framework to carry out research projects. Institutional Review Board (IRB) approval to conduct this study was received (IRB#11-0122) before offering the course. By the end of year one, the university's faculty senate approved FCS 423 as a three credit hour elective.

In year two, the project team began recruiting students for the course. Flyers identifying the new course were posted in various academic buildings and were shared as digital files with faculty from various disciplines at the university. The lead author attended CDL parent-teacher meetings to give families a project overview and allow parents to give assent for their child(ren) to participate. Students granted their consent for study participation. The course was offered in two concurrent remaining years, during fall and spring semesters. In the summer sessions the project team revised the course based on student feedback and on end of course evaluations.

The Course

FCS 423: Nutrition and Gardening Education for Young Children was offered in fall and spring semesters from Fall 2012 to Spring 2015 (with the exception of Fall 2013). Class meetings were held three times per week for a total of 2.5 hours in a 16 week semester. The course consisted of three modules: child development, gardening education, and nutrition education and was taught by project team members. Curriculum was developed to ensure all students (despite their majors) had basic understanding of three core concepts: child development, gardening education, and nutrition education. Upon completion of the course, students were expected to:

- Gain an understanding of the basic principles of gardening and environmental factors affecting vegetable growth;
- Understand the importance of growing, preparing and eating nutritious foods;
- Learn and apply age and developmentally appropriate practices to guide young children through process of gardening from the planning stage to the harvest stage;
- Value the physical, social-emotional, and cognitive benefits of gardening for preschoolers;
- Perform psychomotor skills during gardening activities with preschoolers

Faculty incorporated their knowledge, skills, and expertise to develop the course and its experiential learning activities. All modules consisted of lectures, guest lectures, and gardening and experiential learning activities (with and without preschoolers), and cooperative group exercises. The next sections highlight experiential learning activities for the three modules.

Module 1: *Let's Learn about KIDS*

Child development project team researchers co-taught the child development module, which included topics surrounding emotional, social, and physical development of young children. Students were trained using the Reggio Emilia philosophy, also known as the Project Approach. This philosophy supported preschoolers' emergent learning of healthy eating with gardening activities and concepts. Child development project team members facilitated discussions, guided group activities, and provided case studies on preschoolers' development and relation to well-being. Students also participated in bi-monthly interactions with preschoolers at the CDL by incorporating gardening and nutrition education in activities.

Students received training in the *Be Active Kids* curriculum, an innovative, interactive health program focused on physical activity and nutrition in children ages birth to five years. Students participated in the half-day "train-the-trainer" sessions and received certification as "trainers" in *Be Active Kids.*

Module 2: *More Peas, Please!*

The nutrition module was guided by nutrition project members and by the Child Care Health Specialist, who served as project consultant. Students learned the six basic nutrients (i.e., carbohydrates, protein, fat, vitamins, minerals, and water) and recommended dietary allowances for young children. Additionally, students learned about the new USDA Food and Nutrition Service (FNS) food pyramid and the importance of young children eating balanced meals and incorporating physical activity into their daily lives. The ChooseMyPlate.gov initiative was also a component of the nutrition module.

The second formal training college students received was in *Color Me Healthy*, a curriculum with interactive learning opportunities on healthy eating and physical activity developed for children ages four to five. After training, students created and gave presentations and trainings of the curricula to CDL preschoolers and teachers. Hands-on interactions with preschoolers reinforced concepts learned in the module.

Module 3: *Ready, Set, Grow!*

The gardening education module was co-taught by horticulture project faculty and cooperative extension personnel. In-class lectures and group activities centered on learning parts of the plants, the germination process, vegetable classifications, and when to plant vegetables with regard to their specific requirements (i.e., nutrients, watering) and local climatic contexts. Three gardening plots were built at the CDL to facilitate application of gardening activities. Horticulture project faculty selected various plants and seeds based on the seasons and children's ages. Seedlings used in the gardening activities were produced at the Reid Greenhouse, whose

staff helped with delivering all activities conducted at CDL gardens. Use of seedlings was generally favored against the direct use of seeds. Not only was using seedlings easier for the younger children, but the sight of seedlings increased their motivation and participation to completing the activities.

During the gardening education module students engaged with preschoolers in gardening activities, which focused on planting and maintaining the CDL gardening plots, subject to weather conditions. Experiential learning activities related to this module also included field trips to the University Farm, to the Reid Greenhouse, to on-campus gardening plots, to local farmers' markets, and to the Children's Museum Edible Schoolyard.

Course Evaluations

To assess course learning objectives, three assignments were administered: reflective journaling, a final project, and end of semester student course evaluations. With the first assessment, reflective journaling, instructors provided prompts centered on previous weeks' activities to guide students' thinking. During reflection, students shared what they learned and enjoyed, concerns they experienced, and any other reflective thoughts they had about the activities. Students were encouraged to be open and honest in their writings to increase reliability. Instructors monitored Blackboard to ensure that students completed reflections as instructed. Table 2 discusses results of reflective journaling.

The second assessment was a final project that asked students to develop a lesson plan for young children or an activity integrating child development, gardening education, and nutrition. Class time was offered throughout the semester so that students could engage in small group discussions about their topics and their progress on completing the project. The first cohort of students worked collaboratively on their final project, which was a parent newsletter.

The third evaluative component consisted of results of the students' end of semester course evaluations. The course evaluation was based on criteria defined by the university and was completed in the form of a survey made accessible to students at the end of the semester. Evaluations were disseminated to students via an electronic system based at the university.

Results

Demographic information in Table 1 shows that most students who enrolled in the course were representative from majors of the FCS Department, with a majority being enrolled in Child Development. This may have been due to students' familiarity with two of the project team members who were Child Development faculty. The course was proposed as an elective for horticulture students, which may be the reason they chose other options due to their curriculum including other courses related to vegetable production. Table 1 also shows that the course

attracted a majority of female, African American students, which is reflective of the Child Development major.

Table 2 highlights the results of the reflective journaling. Project team members used thematic coding to analyze students' journal responses. Codes were analyzed around the three modules: child development, gardening education, and nutrition education. Course structure and experiential learning activities were common themes for all modules. Positive comments on the field trips, hands-on activities, and gardening activities were discussed in students' reflections. Students also mentioned they enjoyed learning about areas outside the majors. The project team also coded students' concerns and attempted to improve the course for subsequent semesters. For example, while the initial intent was to propose textbooks as one support for the course, research articles, case studies, and videos were eventually used to address concerns that students expressed. To provide clear and more direct communication to students, instructors also enhanced and expanded use of Blackboard and other online teaching methods (e.g., discussion boards).

Students were assessed on how clear and detailed their responses were during the reflective journaling activity. Scores ranged from 90 – 95 (based on a 100-point scale).

Table 2. Reflections provided by FCS 423 students

General reflections on the course	*Great activities at the CDL, enjoyed field trips and lectures* *We were very hands-on; travelled to different places* *I liked the structure and the course work given* *I enjoyed trips to the farm, children's museum and child lab* *Enjoyed playing the nutrition game and going on field trip* *Wanted to spend more time in the garden, I was ready to dig in the dirt* *I am not a child development major and learned a lot about the CDL*

Reflections on Module 1	*I have gained lots of information that I will take with me to teach my children.* *Enjoyed mostly talking about the kids and what is good for them*
Reflections on Module 2	*I really attained a lot of information to help me become healthier* *Thanks to this class I try eating new foods such as cucumbers and radishes* *This class made me want to know more about healthy food choices*
Reflections on Module 3	*Enjoyed learning about which season is best to plant certain vegetables* *Learned when to plant certain crops depending on weather*
Students' Concerns	*We should use the textbooks more.* *Didn't use the textbooks.* *Sometimes I was confused with the different teachers teaching the course.*

Regarding the final integrative project, the first cohort of students (Fall 2012) worked as a class on creating a newsletter for the CDL parents. The newsletter included health and wellness information, kid-friendly cooking recipes, family fun activities, as well as photos of class and gardening activities. For subsequent semesters, final projects could be individual. Projects varied based on students' majors and interests. Another example of a final project was a "KIDS Coloring Book" containing 20 pages of different colored construction paper. Pictures of various fruits and vegetables of the respective colors were included on each sheet with names of each fruit or vegetable printed neatly at the top of the pages.

Final projects were intended to allow students to integrate and apply knowledge gained in the course. Students presented their projects at the end of the semester as oral presentations and were graded on oral and written communication skills and on incorporation of and appropriate use of terms learned in the course. Grades on the final integrative project ranged from 80 – 95 (based on a 100-point scale; mean score – 90.67; standard deviation - 3.733), indicating students demonstrated above average achievement on goals and objectives for this assignment.

End of semester student course evaluations, which were mandated by the university, ranged from 4.2 to 4.9 (mean score – 4.566; SD - .209) with an average score of 4.55 out of a 5-point Likert scale. Scores increased slightly each semester, suggesting an improvement in course design, communication modes (i.e., student-teacher), and use of effective teaching methods.

Discussion

The authors highlighted an innovative, interdisciplinary gardening education college course focused on experiential learning and on how to work (or educate) young children. The project team explored the effectiveness of an interdisciplinary family science course, FCS 423: Nutrition and Gardening Education for Young Children, which used tenets of gardening education to teach preschoolers healthy eating.

Key concepts from two frameworks were used for guiding students' learning and interactions with preschoolers during gardening activities. The first is the Reggio Emilia philosophy, which provided students a foundation for understanding age and developmentally appropriate ways to teach young children. Employing age and developmentally appropriate activities for preschoolers in the context of an edible garden was a key component of the "Project Approach," which provided students with a framework for teaching health and well-being to young children. The second framework was Kolb's ELT model centering on the integrated experiential learning experiences gained in each of the modules. Through experiential learning activities, collaborative learning, and hands-on gardening activities, students expanded their knowledge and understanding of the integration of child development, gardening, and nutrition.

In the course, students had the opportunity to learn with peers from other majors, which facilitated and stimulated their learning and performance inside and outside the classroom. Students' reflective journaling entries showed they enjoyed the interdisciplinary nature of the course. Based on these conclusions, it would be beneficial to find ways to better attract students from horticulture majors to the course because it would reinforce their disciplinary knowledge. Students also shared the view that while it was "different" learning from faculty outside their majors, they benefited from the use of different teaching styles and learned useful new information they can use for their health and well-being.

Students' reflections also supported their interests in gardening education and nutrition with preschoolers. The gardening education module appeared to have the most effect on students. This is probably due to mostly the emphasis on discussion of new content in this module, since less than one percent of student majors was Natural Resources and Environmental Design (NARS). This could be assumed to due to the experiential learning nature of activities completed in the module.

Students working directly with preschoolers was another new experience. Students reported they enjoyed visiting the CDL gardening plots and teaching preschoolers. Young children also looked forward to having students visit their classroom.

Policies and programs focused on emotional, social and physical development in young children are critical to their healthy development later in life. Along with helping preschoolers meet quality nutritional needs, college students reported improvements in their dietary habits such as drinking more water, eating more fruits and vegetables, eating less junk food, and increased physical activity. Results of this study have implications for family science faculty and researchers interested in developing creative courses to enhance students' learning experiences. The study could enhance knowledge of faculty interested in developing an interdisciplinary course through interdepartmental collaborations.

Limitations

Although families were integral components of children's involvement and often interacted with project team members, the team did not assess parents' perceptions of the project's effectiveness formally. The authors recommend that any replications of this study include evaluation of parents' perceptions of the project, along with surveys to assess parents' knowledge of healthy eating. Another study limitation of the study was that the project director did not evaluate the process of co-teaching and co-developing the course. There were many conversations during team meetings about the development and progress of the course, but formal evaluation would have added information useful for replication in future studies.

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