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Gender and Racial Disparities in a Youth Urban Agriculture Workshop

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Abstract

Urban youth participation in agricultural activities has been linked to positive educational outcomes. This article explores the gender and racial differences in perceived knowledge gain and intended behavior change among youths participating in a youth urban agriculture workshop in 2015. Participants were students from underserved areas in Washington, DC. Female students and Black students had about half-grade higher (0.43–0.63 points) self-reported scores for knowledge change, whereas only female students showed an increase in intent to change behavior. Our results suggest that female students may learn at a faster rate than males and that experiential learning aids Black students in gaining knowledge.

Keywords: gender disparity, race, agricultural education, youth programs, 4-H

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Introduction

Today, a variety of factors intertwine to affect the connections among urbanization, food security, and agriculture. Over half of the world's population and more than 80% of the U.S. population live in urban areas (World Health Organization, 2015). Rapid urbanization results in widespread malnutrition (food insecurity) and obesity in urban areas (McMichael, Powles, Butler, & Uauy, 2007), and most people in urban areas do not know how their food is produced or reaches their supermarkets (Balschweid, Thompson, & Cole, 1998; National Research Council, 1988). This limited knowledge of food production systems among urban residents affects their ability to make informed decisions about diet and food security (Association of Public and Land-grant Universities Experiment Station Committee on Organization and Policy—Science and Technology Committee, 2010). Additionally, the current food system model—producing in rural areas and consuming in urban areas—is not sustainable, as energy consumption for food transportation imposes huge costs on the environment (Halweil 2002; Pirog, 2009). The system faces an additional serious challenge in the United States as the average age of farmers has increased over the last few decades from 50 to 58 years (Vilsack & Clark, 2014). In other words, more and more young people are leaving rural areas for a life in urban areas.

Complex and rapidly changing agricultural systems also present challenges for the education system in preparing the next generation of farmers (Trexler, Hess, & Hayes, 2013), including urban agriculturists. Recent research has shown that urban agriculture is a viable complement to rural food production, enabling urban communities to access local foods and exposing them to food production systems (O'Hara, 2015). Experience with food production also can help urban residents, particularly youths, improve their cognitive skills and enhance their environmental knowledge (Kellert, 2005; Strife & Downey, 2009). However, if urban food production is to be successful, education is required. Frick (1993) showed that rural youths have higher levels of farming and food-related knowledge than urban youths do, emphasizing the need for agricultural education in urban areas. Therefore, we must consider how we can extend agricultural literacy among urban youths who have very little to no knowledge of food production. We also should ask how we can change urban youths' health behaviors, taking into account social cognitive theory (Contento et al., 1995), which describes three types of factors involved in altering health-related behaviors: personal factors (e.g., beliefs, values, and knowledge), behavioral factors (e.g., skills needed to complete tasks and monitor habits), and environmental factors (e.g., influences, surroundings, peer modeling, and parental support) (Bandura, 1986). These questions are important because food insecurity in underserved communities is a growing problem in many urban areas.

In the District of Columbia (DC), there are broad issues related to accessing fresh and healthful food, especially in underserved and low-income areas. More than 14% of all households in DC have food insecurity (representing an increase of 1% over a 4-year span) (Capital Area Food Bank, 2015). For the period 2008–2012, 30.5% of DC households with children indicated that they were unable to afford enough food (Food Research and Action Center, 2013). Nine of the city's Census tracts are classified as *food deserts*, meaning that the majority of residents in those tracts live more than a mile from a supermarket (U.S. Department of Agriculture Economic Research Service, 2014). The local need for a greater understanding of agriculture becomes paramount as the physical disconnect between urban dwellers and agriculture translates into reduced food security (Halweil, 2002; Trexler et al., 2013).

Another area of concern is the development of childhood obesity and nutritional deficits related to diet. With regard to youths 10–17 years old, the National Survey of Children's Health in 2011 ranked DC third among states with youths who were obese (District of Columbia Department of Health, 2014). Food-related illnesses such as obesity, diabetes, and hypertension have reached pandemic levels overall but are especially prevalent among urban populations in food desert neighborhoods that have low densities of grocery stores (Cook & Frank, 2008). In 2014, DC ranked second lowest in obesity rates; however, its lower income wards (Wards 5, 7, and 8) had obesity rates higher than the national average (District of Columbia Department of Health, 2014). Research has indicated that childhood obesity can be addressed through garden-based Extension nutrition programs (Scherr, Cox, Feenstra, & Zidenberg-Cherr, 2013), with students showing increased preferences for vegetable consumption in follow-up surveys (McAleese & Rankin, 2007; Morris & Zidenberg-Cherr, 2002). Also, incorporating nutrition education into urban agricultural Extension programs has been shown to moderate body weight and decrease blood pressure in obese children (Gatto, Ventura, Cook, Gyllenhammer, & Davis, 2011).

To increase students' knowledge of agriculture, diet, and health, schools must consider including food-related programs in their curricula. Doing so would provide students with the opportunity to learn about food production systems and their importance to well-being. To develop any curriculum, schools need to consider gender and cultural background, factors that can influence learning styles as well as food preferences. For instance, female students were shown to score slightly higher than their male counterparts in posttests about agricultural activities after a farm day event in Ohio (Luthman, Ewing, & Whittington, 2007). Findings of similar studies indicated that

Black students knew little about skills needed by professionals in natural resources and agriculture or the possible jobs available in those areas (Frick, 1993; Leatherberry & Wellman, 1988; Prager, 2011). Other studies showed that lecture-based agricultural materials were insufficient for teaching urban youths about agricultural systems because of learning barriers (Birkenholz, Frick, Gardner, & Machtmes, 1994; Hess & Trexler, 2011). Taken together, these studies seem to indicate that there is a need to assess and compare how males and females and Black and non-Black students differ in their knowledge and self-assessment of learning related to agricultural literacy programs; this need served as the guiding framework of our study.

Our purpose was to examine the impact of gender and race on particular key performance indicators (KPIs) relative to a youth urban agriculture workshop (YUAW) developed at the University of the District of Columbia (UDC). The KPIs we focus on herein were change in knowledge and change in behavior. Our program incorporated a short lesson section, hands-on experience training, and an expert-based curriculum that focused on self-discovery. Aspects of our approach, especially the hands-on experience component, have been shown to be effective for youths' retaining of information (Luckey, Murphrey, Cummins, & Edwards, 2013; Ricketts & Place, 2005).

UDC YUAW

The UDC YUAW was a summer program for youths coordinated through a collaborative effort by four centers in UDC's College of Agriculture, Urban Sustainability, and Environmental Science (CAUSES). CAUSES embodies the land-grant tradition of UDC by offering innovative academic and community education programs. The Centers for Sustainable Development and Resilience, Urban Agriculture and Gardening Education, 4-H and Youth Development (4-H), and Nutrition, Diet, and Health collaboratively designed an experiential YUAW for DC students aged 12 to 18 years. UDC 4-H invited six schools from underserved communities in DC to participate in the YUAW at no cost, and four schools agreed to take part. The YUAW was conducted four times during spring and summer 2015. During each event, 25 to 40 students joined a small group of agricultural professionals at UDC Firebird Research Farm in Beltsville, Maryland. The program reflected the CAUSES experiential learning approach (https://www.udc.edu/causes/reports-research/), focusing on giving DC students the opportunity to practice urban food production practices, learn about soil health and farming practices, and experience healthful eating benefits through a demonstration by a CAUSES chef during the program.

During each YUAW, one of the identified DC schools sent 25–40 students to UDC Firebird Research Farm. Students signed in and were randomly organized in four groups. Then groups rotated through four stations, enabling every group to participate in all stations by the end of the program. The stations were as follows:

1. Urban Agriculture Station,
2. Soil Health Station,
3. Farming in Practice Station, and
4. Diet and Health Station.

Station 1's main focus was sustainable food production approaches and the importance of growing food in urban areas. Students engaged in discussion about environmental problems related to food production in the United States and related climate change issues. Then students were shown a working aquaponics system and engaged in discussion about the importance of the system for urban areas, in particular in low-income areas where fresh food access is limited.

In Station 2, students engaged in discussion about soil health and its importance in a sustainable food production system. The students learned about soil structure, different types of soils, and how different soils interact with nutrients and plant growth. During the hands-on experience component, students identified soil types by feel.

In Station 3, a CAUSES expert taught students about seed planting and propagation and maintenance and harvesting of crops. Then the students had the chance to plant seeds and harvest in-season vegetables. Each student also received a small pot and seeds to take care of at home.

In Station 4, a CAUSES chef prepared simple and healthful food (i.e., salad bar and dessert), using produce from the farm. The purpose of this station was to teach students about the importance of eating healthfully and the associated link to local produce.

At the conclusion of the workshop, students were asked to fill in a questionnaire designed to measure their perceptions of their knowledge regarding concepts covered and whether the information provided during the workshop encouraged them to grow vegetables at home or in their community or to eat more healthfully.

Data Collection Methods and Description

Our team developed an outcomes-based survey to evaluate the program outcomes. The survey's main focus was on identifying self-assessed knowledge change and intended behavior change in students. We also collected demographic data on gender, race, and residence area (DC ward). The evaluation variables corresponded to program outcomes. Each variable was scored on a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. There were several advantages to using a Likert scale for our analysis. A Likert scale is suitable for psychometric measurement of attitudes, knowledge, and behavior. In addition, use of a Likert scale enabled us to easily convert our data into a quantitative measurement (Brooke, 1996). All students' responses on each KPI were aggregated into a composite variable to allow for comparison across KPIs.

In total, 144 students participated in the four YUAWs, and 131 completed the survey, which was administered at the end of each YUAW. Surveys were administered by a UDC independent moderator in a classroom setting. After students had completed the survey, the workshop team leader deposited all surveys in a box to ensure anonymity.

The survey respondents included 66 male and 65 female students. The majority of the students were Black (87), followed by Hispanic (17), White (5), American Indian (5), Asian (3), and Native Hawaiian (1). Thirteen students did not provide their race/ethnicity information. To conduct statistical analysis and for comparative purposes, we categorized all non-Black races into the category *non-Black*. A plurality of the participants attended schools in DC Ward 4 (39), followed by Ward 5 (30), Ward 6 (16), and Ward 8 (13). There are eight wards in DC, and large disparities exist among wards in terms of income levels, employment rates, and education (see Appendix A, Table A1, for detailed information about the wards). The students we trained were not from the most affluent neighborhoods in the city. As 33 students did not indicate their wards, ward is not discussed as a key variable in our analysis but rather as a control variable that roughly indicates students' socioeconomic backgrounds. We analyzed data using Stata.

As mentioned, the survey focused on self-assessed knowledge change and intended behavior change. The knowledge and behavior sections of the survey each comprised multiple statements. The students were asked to rate their agreement with each statement on a Likert scale ranging from 0 to 4 (the previously described Likert scale).

The survey's knowledge section had six statements with the following focuses:

1. making compost,
2. aquaponics systems,
3. tomato plant identification,
4. urban food production,
5. clay test, and
6. soil and water.

These six items were integrated into one KPI called *change in knowledge*, as they gauged students' knowledge following the workshop.

The next two statements addressed the student's intention to change behavior and had the following focuses:

1. likelihood of growing plants and
2. likelihood of eating more fruit and vegetables.

These two items were then lumped into a KPI called *change in behavior* (behavior scores being the average of the two questions).

Table 1 shows the mean scores related to each survey statement.

Table 1.
Knowledge and Behavioral Topics and Mean Scores

Statement on questionnaire	**Abbreviation**	***M***
I understand how long it takes to make compost	Making compost	2.97
I understand how an aquaponics system works	Aquaponics systems	2.83
I can distinguish a tomato plant from other plants	Tomato plant identification	2.64
I understand why producing food in urban areas is important	Urban food production	3.23
I understand how to test for clay in my soil	Clay test	3.15
I understand which types of soil "hold onto" water and nutrients the best	Soil and water	3.32

Average knowledge change		2.96
I am more likely to grow my own plants or produce/herbs at home	More likely to grow plants	2.56
I am more likely to eat fruits and vegetables	Eat more fruit and veggies	3.12
Average behavioral change		2.74

Note. Means are based on responses to items involving a Likert scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*).

Quantitative Findings

t-Test Results: Gender and Self-Reported Learning Outcomes

First, we investigated whether males and females learned equally with regard to having knowledge of the topics covered and intending to change behaviors. Table 2 presents the means and standard deviations of female and male students' ratings for each item. Means of female students were higher than those of male students for all topics.

Table 2.

Descriptive Statistics for Each Topic by Gender

	M		*SD*	
Topic	**Female**	**Male**	**Female**	**Male**
Making compost	3.05	2.89	1.67	1.29
Aquaponics systems	2.94	2.72	0.89	0.99
Tomato plant identification	3.12	2.15	1.54	1.34
Urban food production	3.36	3.09	1.19	1.22
Clay test	3.44	2.86	1.29	1.26
Soil and water	3.58	3.06	1.30	1.01
Knowledge change	3.13	2.80	0.61	0.76
More likely to grow plants	2.83	2.29	1.47	1.17
Eat more fruit and veggies	3.23	3.01	1.54	1.39
Behavioral	2.89	2.59	1.07	1.00

change

Note. Data are based on responses to items involving a Likert scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*).

A two-sample *t*-test by gender showed that gender differences bore significance at the 1% level relative to the overall knowledge change as well as to specific knowledge items. The gender difference was at the 5% significance level relative to "more likely to grow plants" and overall behavioral change and at the 10% significance level relative to "aquaponics system." In other words, for these topics, girls reported significantly higher learning outcomes than boys did. This gender difference was not statistically significant for "making compost" and "eating more fruits and vegetables." Data are shown in Table 3.

Table 3.

Two-Sample *t*-Test Results on Knowledge and Behavior Change Scores by Gender

Topic	*t*	*df*
Making compost	−0.5875	129
Aquaponics systems	−1.3124*	129
Tomato plant identification	−3.8301***	129
Urban food production	−1.2906*	129
Test clay	−2.5917***	129
Soil and water	−2.5202***	129
Knowledge change	−2.7175***	127
Likelihood of growing plants	−2.3257**	129
Likelihood of eating more fruit and vegetables	−0.8281	129
Behavioral change	−2.0329**	126

Note. All results reflect one-sided *t*-test. ***$p < 0.01$. **$p < 0.05$. *$p < 0.1$. Behavior transformed to behavior squared.

t-Test Results: Race and Self-Reported Learning Outcomes

The second concept we addressed was students' self-reported knowledge levels and levels of intent to change behaviors in relation to reported race. Table 4 shows the means and standard deviations of Black and non-Black students' ratings for each item. The data indicate that compared to the aggregated scores of non-Black students, Black students' scores were higher for topics in the "knowledge" category (2.85 compared to 3.06, respectively), and lower for topics in the "behavior change" category (2.92 compared to 2.72, respectively).

Table 4.

Descriptive Statistics on Each Topic by Race Category

	M		*SD*	
Topic	**Non-Black**	**Black**	**Non-Black**	**Black**
Making compost	2.97	2.95	1.08	1.45
Aquaponics systems	2.77	2.90	0.88	0.92
Tomato plant identification	2.65	2.64	1.05	1.46
Urban food production	2.90	3.33	1.22	0.94
Test clay	2.90	3.33	1.16	1.05
Soil and water	2.94	3.40	1.12	1.03
Knowledge change	2.85	3.06	0.82	0.57
More likely to grow plants	2.87	2.47	1.09	1.16
Eat more fruit and veggies	2.97	3.14	1.08	1.46
Behavioral change	2.92	2.72	0.99	1.00

Note. Data are based on responses to items involving a Likert scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*).

Overall, Black students' scores on knowledge change were statistically different than those of non-Blacks at the 10% significance level, with three specific topics (urban production, clay test, and soil and water) at the 5% significance level and three topics (making compost, aquaponics systems, and tomato plant identification) not significantly different. With regard to scores for intent to change behavior, Black students' scores for the intended behavior change "eat more fruits and veggies" were not significantly different from those of non-Black students, and their scores for "more likely to grow plants" were significantly lower than those of non-Black students, at the 5% significance level. Data are shown in Table 5.

Table 5.

Two-Sample *t*-Test Results on Knowledge and Behavioral Change Scores by Race

Topic	**Comparison**	***t***	***df***

Making compost		0.0480	116
Aquaponics systems		−0.6447	116
Tomato plant identification		0.0052	116
Urban food production	Black students' scores higher	−2.0213**	116
Clay testing	Black students' scores higher	−1.8987**	116
Soil and water	Black students' scores higher	−2.1180**	116
Knowledge change	Black students' scores higher	−1.4936*	114
More likely to grow plants	Non-Black students' scores higher	1.6740**	116
Eat more fruits and veggies		−0.5945	116
Behavioral change		0.9362	114

Note. All results reflect one-sided *t*-test.
***$p < .01$. **$p < .05$. *$p < .1$.

We furthered our analysis by using ordinary least squares (OLS) models to examine which factors affected self-reported learning outcomes by controlling for every other factor. Model specifications and detailed results are included in Appendix B. The regression results showed that in our study, the variable female or Black corresponded to higher self-reported knowledge scores by 0.43 and 0.45 points, respectively, and that that correspondence bore statistical significance at the 1% level (see Appendix B, Tables A2 and A3). In general, female students had higher intended behavioral change scores than male students by 0.63 points ($p <. 01$) (Table A2), and being Black did not affect scores in the behavioral change section.

In summary, *t*-test and OLS regression results showed that female students had 0.43–0.63 higher scores for both self-reported knowledge and intended behavioral change as compared to males. The *t*-test and OLS regression results also showed that as compared to non-Black students, Black students had about half a grade (.45) higher self-reported scores for knowledge but that their intended behavioral change scores were not significantly different.

Discussion and Recommendations

Our findings showed that youths felt positive about knowledge of concepts and had intention to change behaviors as a result of their involvement in the UDC YUAW. Indeed, both boys and girls and Black and non-Black students demonstrated increases related to the KPIs we studied. Although there may not be a comparable study about youth involvement in a formal urban agriculture program, we can draw parallels between our study and existing studies regarding urban youth involvement in agricultural education.

Gender Differences Relative to Changes in Knowledge and Behavior

One key finding was the differences observed related to the gained knowledge that girls and boys reported. There are two possible explanations for the observed gender differences. First, our findings may indicate that girls did indeed learn more than boys. This suggestion is in line with other studies that have demonstrated that girls might have higher learning levels than their male counterparts (Booth & Nolen, 2012; Bruckman, Edwards, Elliott, &

Jensen, 2013). Second, it is possible that the female students just thought they had learned more as the scores were self-reported and not the result of an actual knowledge-based test. In follow-up qualitative studies, researchers could provide further insight about this observation by examining whether girls actually learn more than boys or their perceptions make them appear to learn more.

Racial Differences Relative to Changes in Knowledge and Behavior

Another key finding was that Black students reported higher levels of knowledge than their non-Black counterparts. One factor behind this finding could be the inclusion of the "hands-on" or experiential learning component in the program. Black students may have found the hands-on experience to be new, and, it therefore may have caught their attention. Other studies confirm that engagement in experiential learning activities tends to foster higher levels of dissonance (Seaman & Rheingold, 2013) than other methods, such as rote memorization or lecture. Thus, when practitioners are planning future programs involving Black youths, they should consider embedding an experiential learning component into program design.

Although our program fostered higher levels of perceived knowledge for Black youths, there were no significant differences between perceptions of intent to change behavior for Black and non-Black students. Many factors could underlie this finding. Traditionally, urban Black youths have experienced inequitable social and economic conditions (Franklin, 2014). Thus, there may not have been many instances prior to our workshop when the Black youths were exposed to healthful eating options. In addition, space is mostly very limited in areas where underserved communities live. Therefore, it may not be possible for Black youths, due to space limitations, to harbor their own growing spaces.

Study Limitations and Other Observations

During our workshop, we focused on all three types of factors described in social cognitive theory to make sure that students would have the opportunity to learn about agriculture, food, and diet and change their behavior by eating more healthful foods. We recognize, however, that a single 2-hr workshop with posttest only assessments presents limited exposure for students and limited evaluation of possible resulting gains. Additionally, lack of a postworkshop follow-up may have limited the impact of the workshop in the long term. Lastly, in our study, we could only use ward as a proxy for students' familial socioeconomic indicators. Students' families' incomes or their parents' highest levels of education achieved would be other important variables to include if such a study were to be repeated in the future.

Implications for Extension

Our study contributes to the growing body of literature that demonstrates the need for Extension work in urban areas. We showed that there is a need to infuse food-related education in school curricula, particularly in underserved urban areas, and to foster schools' use of agriculture and food production systems as tools in their educational programming. Empowering teachers to use urban agricultural practices to teach math, literature, science, and history will lead to giving students better opportunities to learn about these disciplines in practical ways. A YUAW model can be developed by schools to expose students to the benefits of healthful eating. Second, as our results demonstrate, a YUAW is an effective tool for helping close the opportunity gap between Black and non-Black students as Black students showed demonstrable self-reported knowledge change and intentions toward behavior change. Extension professionals aiming to improve equitable outcomes for Blacks should look to the YUAW design as a method for achieving this goal. Lastly, we have to continue to think intentionally regarding the provision of Extension education relative to gender. As our results confirm, boys and girls have varying levels of knowledge acquisition and intent to change behavior. Thus, Extension professionals might employ new methods that aim at providing boys and girls with greater chances to learn. Examples of this approach could include combining traditional teaching methods with nontraditional methods, such as those that provide more experiential learning opportunities.

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Appendix A

Demographic Data for District of Columbia Wards

Table A1.

Selected Indicators for All Wards in Washington, DC, 2011–2015

Ward	Average household income	Unemployment rate	Persons without a high school diploma
1	$113,972	6.5%	12.0%
2	$209,147	3.8%	5.3%
3	$257,224	3.7%	2.1%
4	$123,353	9.8%	13.0%
5	$82,425	14.0%	14.0%
6	$140,853	6.2%	7.5%
7	$56,759	19.0%	17.0%
8	$45,239	23.0%	17.0%

Source: Neighborhood profiles, NeighborhoodInfoDC. https://www.neighborhoodinfodc.org/wards/wards.html

Appendix B

Regression Specifications and Detailed Results Tables

We used the following ordinary least squares models to examine what factors affect self-reported learning outcomes:

$$Knowledge = \alpha_0 + \alpha_1 black + \alpha_2 female + \alpha_3 ward\ dummy + error$$

$$Behavior = \alpha_0 + \alpha_1 black + \alpha_2 female + \alpha_3 ward\ dummy + error$$

In the models, $black$ is a dummy variable indicating race being Black, $female$ is a dummy variable indicating gender being female, and $ward\ dummy$ involves four dummy variables for Wards 4, 5, 6, and 8, with students who do not live in any of these wards as the baseline group. Students from Ward 4 and Ward 8 tended to have higher self-reported knowledge scores by 0.36 and 0.42, respectively ($p < .1$) (Table A2). In addition, students from Ward 5 averaged a lower intended behavioral change score of 0.48 ($p < .1$), and students from Ward 8 averaged a higher score of 0.76 ($p < .05$) (Table A3).

Table A2.

Simple Linear Regression Results for Knowledge

Dependent variable: knowledge

N = 129; Adj R^2 = 0.0936

Variable	Coefficient	St. err.
Black	.4524***	.1647
Female	.4293***	.1330
Ward 4	.3573*	.1971
Ward 5	.0695	.1740
Ward 6	.2085	.2099
Ward 8	.4174*	.2280
Constant	1.8308***	.2789

***$p < .01$. **$p < .05$. *$p < .1$.

Table A3.

Simple Linear Regression Results for Behavioral Change

Dependent variable: behavior

N = 128; Adj R^2 = 0.0907

St.

Variable	Coefficient	err.
Black	.1167	.2435
Female	.6335***	.1965
Ward 4	.2932	.2913
Ward 5	-.4751*	.2570
Ward 6	.5088	.3164
Ward 8	.7596**	.3367
Constant	1.6041***	.4120
***p < .01. **p < .05. *p < .1.		