

HOW DO COLLEGE STUDENTS LEARN ABOUT FOOD SYSTEMS?: A DESCRIPTIVE
ANALYSIS

by

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Abstract

Research specific to the agriculture literacy of adult learners and, more specifically, college students, is warranted (Kovar & Ball, 2013). In the current study, I analyze the sources of knowledge that are dispersed across formal, non-formal, and informal learning settings that college students rely on to understand the various components of food systems. More specifically, I ask here, “How do college students learn about food systems?” Data were collected using a convenience sample of undergraduate students at a large research-intensive university who responded to an authentic questionnaire developed specifically for this study. Findings indicate that there is little variation between the three learning settings with respect to food system knowledge. This indicates that education with respect to food system knowledge is lacking. Implications of the study include recommendations for the development and refinement of formal and non-formal food systems curricula specific to the needs, backgrounds, and experiences of undergraduate college students.

Keywords: Collegiate agricultural literacy, agriculture knowledge acquisition, food systems

Introduction

Agriculturally based issues (e.g., food safety, food security) are among of the most pressing challenges that confront contemporary society (DiBenedetto, Lamm, Lamm, & Myers, 2016). Subsequently, a wide range of public campaigns are underway to enhance the knowledge individuals have about agricultural consumption and production (Meunier, Talbert, & Latour, 2002). In some cases, the public is exposed to agricultural information non-formally through publicly available media (Bowen, Stephens, Childers, Avery, & Stripling, 2013), while in other cases agricultural topics are integrated into formal curricula; especially at the K-12 levels (Powell, Agnew, & Trexler, 2008). Individuals can also develop an understanding of agriculture more informally through routine interactions and experiences had within their families, their workplaces, and the organizations in which they belong (Foreman & Retallick, 2012). The many ways in which agricultural knowledge is acquired and transmitted has created a diverse and often contentious range of perceptions of agricultural production and consumption. This is compounded by public campaigns that are typically anchored at the poles of a two-sided debate between advocates for mainstream agriculture and those for alternative agriculture (Beus & Dunlap, 1990). Despite the intensity and pervasiveness of this debate and the need for public awareness of underlying topics relevant to food and fiber consumption and production, there remains a need for greater understanding of how individuals, and especially those of college-age, acquire relevant and trustworthy agricultural knowledge (Kover & Ball, 2013). Subsequently, I aimed to develop a stronger understanding of how undergraduate students at a large, research-intensive university acquire agricultural knowledge, and more specifically that of which pertains to food systems, through formal, non-formal, and/or informal channels.

The agriculture literacy movement works to develop within learners a comprehensive understanding of agriculture through the delivery of curricula that captures a range of interconnected information, knowledge, and attitudes (Vallera & Bodzin, 2016). Curricula and instructional initiatives designed to foster agricultural literacy have become increasingly embedded within formal coursework, especially that which is based in the science, technology, engineering, and mathematics (STEM) disciplines in the K-12 setting (Anderson, Velez, & Thompson, 2014; Frick, Birkenholz, Gardner, & Machtmes, 1995). Concurrently, youth development organizations, such as FFA and 4-H, have taken an active role in introducing students to various agricultural topics through a range of instructional models (Powell et al., 2008). While an important component of improving agriculture literacy levels around the nation, it excludes a large portion of the population, namely those who are not enrolled in K-12 education. Unfortunately, the extensiveness of the agricultural literacy movement has been primarily confined to school-based settings and has thus failed to reach adult learners (including those in post-secondary education) (Kovar & Ball, 2013).

I am currently focused on how college students acquire information specific to one primary component of agriculture: food systems. Food systems span the entire process of food production and consumption beginning with planting and harvesting and ending with disposal (Chase & Grubinger, 2014). Food systems are highly complex and interwoven across local, regional, national, and global environments and economies (Born & Purcell, 2006). Food systems are generally described as the components of the agriculture network specific to food and the energy that is supplied for each component (Woods et al., 2010).

Food systems are commonly viewed as highly contentious spaces that are influenced and shaped by competing views of how food production and consumption models affect the health

and well-being of individuals, communities, and natural environments (Terry & Lawver, 1995). In a study of the agricultural literacy of undergraduate students pursuing degrees in agricultural education, Martin and Enns (2017) explored the differences in perceptions of mainstream agriculture versus those of alternative agriculture. On one hand, mainstream agriculture proponents advocated for highly technical, large-scale systems that are thought to be able to produce mass quantities of food to match the demands of a growing world population (Martin & Enns, 2017). On the other hand, alternative agricultural proponents supported the perceived merits of small-scale food systems that rely on progressive strategies (e.g., organic farming) to produce the food needed to supply local and regional communities and economies (Martin & Enns, 2017). The merits of each side of this debate are beyond the scope of the current study. Instead, the purpose here is to understand how, if at all, college students acquire the information and knowledge needed to make informed decisions about their position and/or participation in food production and consumption.

Theoretical Framework

Learning Environments: Formal, Non-Formal, and Informal

In a study of agricultural epistemologies, Mars and Ball (2016) illustrated how adult learners (including college students) develop an awareness and understanding of food systems through formal, non-formal, and/or informal learning. Here, I examined the implications of each of the three learning settings on college student acquisition of food system knowledge. More specifically, I sought to better understand how college students develop food system knowledge within and at the various intersections of the three learning settings (see Figure 1).

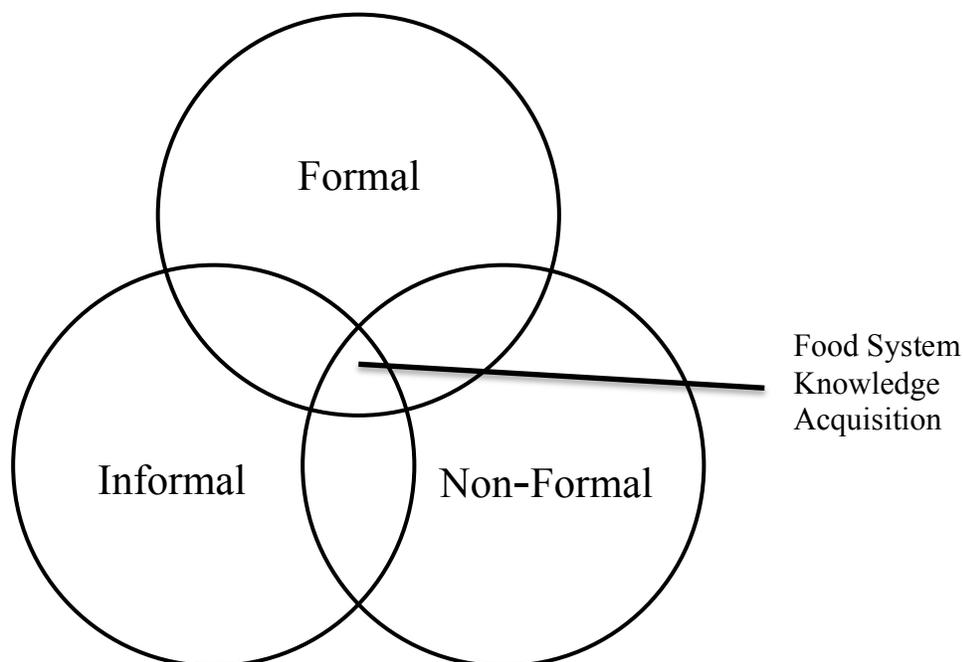


Figure 1

Intersections between learning settings

The knowledge gained by students through conventional classroom instruction is reflective of the formal setting (Etling, 1993). Formal learning involves students engaging in classes that are guided by structured curricula and mandated assessments. The formal setting is representative of graded educational systems that involve planned academic tracks and specialized programs of study (Coombs, 1973). These systems span the primary, secondary, and post-secondary levels. In the context of agricultural education, those who fall under the formal setting will have completed elementary, secondary, and/or collegiate courses that either center on agriculture or include agricultural topics as a curricular component. More specific to the current study, formal coursework is examined as a potential origin of college student awareness and understanding of food production and consumption.

Knowledge of food systems acquired through semi-structured education is representative of non-formal learning. More specifically, the non-formal learning setting intentionally facilitates

learning outside of formal learning environments (Kleis, 1973). For example, non-formal learning of agriculture is understood to occur through 4-H groups and other Cooperative Extension programs. Also, the emergence and expansion of college clubs and organizations that are focused on food security and justice, community gardening, and environmental sustainability can also be considered to be non-formal sources of food system knowledge (Foreman & Retallick, 2012).

Informal learning is defined as unstructured learning that occurs through unplanned interactions and intimate experiences (Ettling, 1993). Any knowledge of food systems that is gained through cultural traditions, family practices, community activities, social networking, and/or self-education is reflective of informal learning. Examples of informal learning settings relevant to food systems include community and family activities involving food production and/or consumption, participation in CSA's (community supported agriculture shares), and consumer-producer interactions at farmer's markets.

Food System Components

According to Chase and Grubinger (2014), a food system is composed of the following seven components: production, processing, packaging, distribution, marketing, consumption, and disposal of food. Production is the process of growing and harvesting the plants and raising the animals used for food consumption (Centers for Disease Control and Prevention, 2015). Processing involves the conversion of raw ingredients into consumable food products (Fellows, 2017). Packaging is the process of encasing food products in containers with the intent of preserving product integrity (aesthetics and safety) during the duration of distribution (Robertson, 2016). Distribution involves transporting food products from production and packaging sites to locations that are directly accessible to consumers (Perner, 2008). Perner also

defined marketing as the promotion and selling of food products to consumers. Consumption refers to the purchasing and use of food products by consumers (Glanz, Basil, & Maibach, 2003). Finally, disposal of food is the permanent removal of inedible products from the food supply chain (Centers for Disease Control and Prevention, 2015). These seven components provided the framework for the questionnaire developed specifically for the current study.

Kramer and Sias (2014) identified five different sources of knowledge within the context of interpersonal communication models. These five sources were utilized to determine where each student had learned about each food system component. The sources include: family, education, peers, previous organization experiences, and media. *Family* involves information that had been shared through relationships that are within a family structure. Examples of this include parent-child relationships or sibling relationships. *Education* involves information gained through formal curricula. *Peers* involves information that has been gained through interactions between people of equal abilities, qualifications, age, social status, etc. (e.g., friends, classmates, colleagues). *Previous organization experience* involves information that has been shared through an organizational affiliation, such as with clubs or places of employment. Lastly, *media* involves information gained through various media channels (e.g., television, radio, newspapers, social media platforms).

For the current study, the preceding five knowledge sources (Kramer & Sias, 2014) were categorized according to the formal, non-formal, or informal learning settings. Education was considered to be representative of formal learning, while previous organization experience was associated with non-formal learning. Family, peers, and media were all associated with informal learning.

Purpose and Objectives

Mars and Ball (2016) called for research that examines agriculture literacy as a lifelong learning process. Consistent with this call, the purpose of this study was to examine how students at an urban research university came to know what they know about food systems via formal, non-formal, and/or informal learning settings. The following research question guided the study: “How do college students learn about food systems?” The following four research objectives guided the study:

1. Describe the demographic characteristics of the university students who attended the campus farmers’ market.
2. Describe the preceding students’ perceived food system knowledge.
3. Describe which sources were most influential in contributing to the preceding students’ food system knowledge .
4. Describe the differences in results between the ‘field’ demographic.

By addressing these four objectives, I aimed to contribute to Priority Number Four (Meaningful, Engaged Learning in All Environments) of the AAAE National Research Agenda (Roberts, Harder, & Brashears, 2016).

Procedures

My study was designed to examine, using quantitative methods, the sources of food system knowledge of students who were shopping at the campus farmers’ market, an informal learning setting that occurs at a Southwest Land Grant University (SLGU) campus. (Hereafter, food system knowledge is referred to simply as FSK). The target population for this study was undergraduate students at the SLGU during the spring 2017 semester. The sample participants

are best characterized as undergraduate college students who attend the farmers' market located on the main campus of the SLGU.

Student participants were selected using a convenience sampling method (Farrokhi & Mahmoudi-Hamidabad, 2012). This sampling method was chosen because of the chaotic nature of farmers' markets and the inability to efficiently utilize alternative methods such as simple random sampling or stratified sampling. I attended the farmer's market and approached students in attendance to ask if they were undergraduate students at the SLGU. I asked those that identified as SLGU undergraduate students to voluntarily participate in the study, which involved completing a questionnaire.

The questionnaire was designed to gain an understanding of the origins of the participants' FSK. It was composed of five items specific to demographic information, knowledge of the seven food system components (Chase & Grubinger, 2014), and the five sources of FSK (family, education, peers, previous organization experiences, media) (Kramer & Sias, 2014). More specifically, each aspect of the food system was accompanied by five sub-categories that were intended to measure where the participants' gained knowledge of each particular component of the food system. A description of each component of the food system (Chase & Grubinger, 2014) was included in the questionnaire. The definitions were included so as to decrease confusion concerning the meaning of each component. After reading each component description, each participant would individually determine how much each of the five knowledge sources as articulated by Kramer and Sias (2014) had contributed to their understanding of each food system component. A five-point Likert scale was used to measure each item. The Likert scale was designed as follows: 1= Contributed nothing, 2= Contributed Slightly, 3= Contributed Some, 4= Contributed More, 5= Contributed Significantly. I ranked

each of the five sub-categories by overall means to indicate how much each of the sub-categories had contributed to the perceived knowledge of each food system component.

Measurement error was addressed by following the protocols for establishing validity and reliability (Rogelberg, 2008). Content and face validity were established using a panel of five experts who were selected based on their expertise within various disciplines of agriculture (e.g., agricultural education, agricultural economics, rural sociology) and instrumentation design. The process yielded a reduction in systematic error through clarification in the wording of each item. Reliability estimates of the measures were established through a pilot-test of students ($n=20$) throughout the SLGU who approximated the subjects. Students who participated in the pilot test included students in an upper division agriculture class, as well as students from a campus organization that was comprised of a variety of backgrounds. Acceptable reliability estimates were determined a priori to be .70 or higher, which is consistent with industry standards (Nunnally, 1967). The calculated test-retest reliability estimates (i.e., coefficient of stability) for items were found to be .75 to 1.0. Because the reliability estimates all fell above .70, all questions and constructs were retained.

Data was collected in the spring of 2017. A five-dollar gift card to a national retail coffee shop chain was offered to prospective participants as an incentive for completing the questionnaire. Ultimately, the sample included 50 student participants. The use of a non-probabilistic sample technique eliminated any potential concern over frame or selection error (Baker et al., 2013). Additionally, the sampling technique used prevented any generalization of the results beyond the participants.

The exploratory research design of the study allowed for the identification and description of the various characteristics of college student FSK and knowledge acquisition as

indicated in the proffered research objectives (Creswell, 2014). Data were summarized using measures of central tendencies and measures of variability appropriate for the scale of measurement (Pearson & Tukey, 1965). First, demographic characteristics of the participants were captured to describe who completed the questionnaire. These characteristics were explored both to ensure that each participant was a current SLGU student and to identify any commonalities between certain demographic characteristics and FSK. The other characteristic explored through this study was the participant's origin of knowledge on different food system components. Also, I ranked each of the five sub-categories to indicate how much each of the sub-categories had contributed to knowledge of each food system component. Each of the objectives were analyzed using means and standard deviations.

Findings

The first objective was to identify the demographic variables of the college students who participated in the survey process. Of the participants, 28% ($n = 14$) identified as male, 68% ($n = 34$) identified as female, 2% ($n = 1$) identified as non-binary/third gender, and the remaining 2% ($n = 1$) self-described as 'she'. The distribution of race across the sample was as follows: Caucasian 54% ($n = 27$), Hispanic or Latino 26% ($n = 13$), African American 8% ($n = 4$), Asian/Pacific Islander 6% ($n = 3$), Other 4% ($n = 2$), and Native American or American Indian 2% ($n = 1$). Of the participants, 10% ($n = 5$) were freshmen, 18% ($n = 9$) were sophomores, 24% ($n = 12$) were juniors, and 48% ($n = 24$) were seniors. The final demographic variable that I captured through the questionnaire was the college in which each student was pursuing a primary degree (i.e., major). The distribution of college representation was as follows: College of Public Health 22% ($n = 11$), College of Social and Behavioral Sciences 14% ($n = 7$), College of Agriculture and Life Sciences 12% ($n = 6$), College of Education 12% ($n = 6$), College of Science

12% ($n= 6$), College of Engineering 10% ($n= 5$), College of Medicine 10% ($n= 5$), College of Architecture, Planning & Landscape Architecture 6% ($n= 3$), and the College of Fine Arts 2% ($n= 1$).

The second objective was to describe students' perceived FSK. Table 1 displays measures of central tendency, including range, mean, and standard deviation, among the seven components of the food system (Chase & Grubinger, 2014). The highest means across the seven components of the food system were associated with consumption and production. In fact, these are the only two components of the food system that fall above an average of 3. Conversely, the lowest means across the seven components of the food system are packaging and distribution, which are tied at a mean of 2.66. The lower the standard deviation with respect to each food system component, the less variation from the mean the compiled responses were.

Table 1

Aggregated Food System Knowledge Means ($n= 50$)

	Minimum	Maximum	Mean	Std. Deviation
Production	1.60	4.40	3.10	0.68
Processing	1.20	4.40	2.94	0.71
Packaging	1.00	4.40	2.66	0.85
Distribution	1.00	4.00	2.66	0.66
Marketing	1.00	4.20	2.93	0.75
Consumption	2.20	5.00	3.25	0.64
Disposal of Food	1.00	4.60	2.89	0.70

Note. Likert scale defined as follows: 1= Contributed nothing, 2= Contributed Slightly, 3= Contributed some, 4= Contributed more, 5= Contributed Significantly.

The third objective was to describe the levels of influence each knowledge source (Kramer & Sias, 2014) had on the students' perceived FSK. Table 2 displays measures of central tendency among these five knowledge sources with each source being averaged across all seven food system components. The highest means in terms of knowledge sources were education (3.31) and media (3.24). Conversely, the lowest source of knowledge among the components of the food system was peers (2.57).

Table 2

Aggregated Knowledge Source Means (Kramer & Sias, 2014) (n= 50)

	Minimum	Maximum	Mean	Std. Deviation
Education	1.71	5.00	3.31	0.74
Media	1.29	4.71	3.24	0.76
Family	1.29	4.71	2.79	0.89
Previous Organization Experience	1.00	4.29	2.69	0.72
Peers	1.00	4.14	2.57	0.73

Note. Likert scale defined as follows: 1= Contributed nothing, 2= Contributed Slightly, 3= Contributed some, 4= Contributed more, 5= Contributed Significantly.

The fourth objective was to describe the differences in results between the disciplinary fields represented within the sample as reflected by the college in which each student was pursuing their primary degree of study. These data revealed the average influence of knowledge sources of those students pursuing degree programs in the College of Agriculture and Life Sciences (CALs) and those pursuing degree programs outside of CALs (i.e., non-CALs). Because of an uneven distribution within fields (some majors were better represented than others

within the sample), I opted to compare CALS students with non-CALS students. As illustrated in Table 3, CALS students indicated on average gaining more FSK from family, education, and previous organization experience than did non-CALS students. Conversely, the non-CALS students reported gaining more FSK from peers and media than did CALS students.

Table 3

Knowledge Source Averages between CALS and non-CALS participants (n= 50)

	CALS Participants (n= 6)	Std. Deviation	Non-CALS Participants (n= 44)	Std. Deviation
Education	3.55	.99	3.25	.47
Previous Organization Experience	3.21	.88	2.66	.55
Family	3.00	1.04	2.84	.74
Media	2.74	.48	3.44	.65
Peers	2.55	.74	2.62	.66

Note. Likert scale defined as follows: 1= Contributed nothing, 2= Contributed Slightly, 3= Contributed some, 4= Contributed more, 5= Contributed Significantly.

Discussion, Implications, and Recommendations

The findings suggested that overall college students know little about food systems beyond basic principles of production and consumption. This insight is consistent with the lack of attention given to adult learners in general by agricultural literacy practitioners and scholars (Kovar & Ball, 2013).

Incomplete knowledge of food systems presents a challenge for improvement within both the higher education and the Cooperative Extension systems. The opportunity to integrate FSK into various academic fields presents itself in the form of designing curricula to align with

specific academic interests. Designing curricula could include integrating food system concepts with the content that currently composes existing curricula. For instance, the incorporation of information relevant to the 'marketing' component of food systems could be integrated into business and/or fine arts courses with the objective being to understand the creativity and strategy behind food advertisements and public awareness campaigns. Similarly, food disposal topics could be integrated with anthropology courses with emphasis being placed on historical patterns and cultural variations in waste practices. While opportunities to design curricula to include FSK exist throughout the university, this concept could also be readily applied in existing agriculture-specific courses.

Strategies for further introducing college students to FSK via non-formal learning channels should also be considered. For example, students of disciplinary backgrounds should be encouraged to participate in (or attend the events sponsored by) campus clubs with a focus on food production and/or consumption (e.g., sustainability organizations, community garden groups) (Foreman & Retallick, 2012). Additionally, new ways to engage college students in Cooperative Extension activities could also prove effective in expanding student FSK. This engagement could be promoted through more direct, campus-based marketing of Extension activities and events and the inclusion of service learning projects involving student participation in such activities and events in formal coursework.

Student FSK can also be further enhanced through more purposeful informal learning strategies. For example, the initiation of targeted social media campaigns that have the goal of objectively informing the college student demographic about food consumption and production. Another opportunity can include the designing of formal curricula that would highlight how family structure is important to food system structure, and informal environments more

generally. This curriculum should not be developed to change perspectives on agriculture. Instead, the purpose should be to provide a holistic, objective view of agriculture. Additionally, the variations associated with existing informal sources of FSK should be carefully considered during the development and implementation of the aforesaid recommendations specific to formal and non-formal learning approaches.

Finally, Kramer and Sias's (2014) five knowledge sources are not exhaustive and thus do not encompass all vital types of food-related information outlets. In particular, the five knowledge sources do not account for face-to-face settings in which food producers and consumers directly interact (e.g., farmers' markets) (Brown & Miller, 2008). This is a setting that would not fall directly under any of the knowledge sources that Kramer and Sias (2014) provide. It is important to be mindful of this with regards to future research in this area.

Lastly, my study illuminates important opportunities for future research specific to agriculture literacy of college students, which remains a relatively overlooked phenomenon (Kovar & Ball, 2013; Mars & Ball, 2016). Studies that explore similar questions/objectives to those we have examined here using qualitative methodologies are encouraged. Such research should be designed to bring greater context and deeper understanding to the findings I have presented and discussed here. Furthermore, further, more detailed examination of variations in the agricultural knowledge and perspectives held by college students according to disciplinary backgrounds, life experiences, geographical location (i.e., rural vs. suburban vs. urban), and organizational affiliations is encouraged. Finally, my study has focused on a specific aspect of agricultural literacy: food systems. Similar research that expands the scope of agricultural literacy to include additional dimensions (e.g., fiber production and consumption, public policy and regulation) is warranted.

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