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Produce Safety University Impacts Child Nutrition Specialist Work

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KEYWORDS: produce, food safety, training, knowledge, confidence

INTRODUCTION:

The National School Lunch Program (NSLP) and the National School Breakfast Program (SBP) are programs administered by the United States Department of Agriculture's (USDA) Food and Nutrition Service (FNS). Over 95,000 schools/institutions serve lunches to more than 29.7 million students each day (School Nutrition Association [SNA], 2025), with approximately 50% of students qualifying for free or reduced-price meals to address food insecurity (National Center for Education Statistics, 2023). Reimbursable meals must meet specific nutritional standards outlined in the Healthy, Hunger-Free Kids Act (USDA, 2024). The NSLP requires ½ cup of fruits and ¾ cup of vegetables (USDA FNS, 2024b), while the SBP requires inclusion of one cup of fruit (USDA FNS, 2024c). The Fresh Fruit and Vegetable Program provides free, fresh fruit and vegetable snacks to children at eligible elementary schools (USDA FNS, 2022). Produce provided in school meals must be grown in the United States (U.S.) as part of the Buy American Provision, with exceptions allowed due to shortages or excessive cost (USDA FNS, 2024a). Schools incorporate local produce to support local economies, offer fresher and more seasonal foods, enhance Farm to School efforts, and create educational opportunities. Research showing that these programs increase students' willingness to try produce and reduce plate waste further drives interest in using local foods (Elnakib et al, 2024; Walshe et al., 2024). Findings from the Farm to School Census indicated that 74.1% of school food authorities reported participating in farm-to-school activities during the 2022–2023 school year (USDA, 2024).

The safety of uncooked fresh produce in the U.S. has been a concern, as there is no kill step to eliminate pathogenic microorganisms. Fresh produce was identified in most of the foodborne illness outbreaks (n=85) tracked to schools, colleges, and universities, and has been implicated in multistate outbreaks (Centers for Disease Control and Prevention [CDC], 2025; Carstens et al., 2019). The Food Safety Modernization Act (FSMA) Produce Safety Rule (PSR), established in 2016 (Food and Drug Administration [FDA], 2024), requires science-based minimum standards for the safe production, harvesting, packing, and holding of fruits and vegetables grown for human consumption. In addition to compliance with USDA nutritional standards for breakfast and lunch, retail food establishments, such as school meal programs, must follow state or local health regulations based on the FDA's Model Food Code (FDA, 2022). The Person in Charge (PIC) is to be knowledgeable about food safety risks, and food used in operations is to be sourced from approved suppliers. However, fresh, unprocessed produce can be purchased from any source (FDA, 2022). Therefore, it is incumbent upon the purchasing agent to ensure the product's safety.

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To aid school foodservice staff in managing food safety risks associated with fresh produce, a one-week training course was developed jointly by USDA's FNS and Agricultural Marketing Service (AMS) in 2010, called Produce Safety University (PSU) (USDA FNS, 2025). PSU is an in-depth course envisioned to be modeled on a train-the-trainer approach with supporting resources available to participants, addressing safe handling of produce purchased from traditional suppliers, direct from farmers, and through the Department of Defense (DoD) Fresh program. Train-the-trainer courses are designed to increase knowledge, influence attitude and behavioral changes, and support the spread of information (Pearce et al., 2012; Rubak et. al., 2008; Orfaly et al., 2005). The PSU curriculum is based on the Theory of Planned Behavior (TPB) and the related concept of perceived behavioral control (PBC), which is a person's belief in their ability to perform a behavior shaped by self-efficacy and the presence or absence of barriers (Ajzen, 1988). The PSU curriculum includes information on how produce is grown, harvested, and processed, along with guidance on how buyers can ensure that safe, high-quality products are purchased and used in school meals. The curriculum includes experiential learning components with a field trip to growers, packers, and processors, and a hands-on "Produce Labs" to demonstrate concepts related to quality and safety. Produce is a complex food category, as each type of fruit and vegetable has production, harvesting, processing, and storage methods specific to each item and growing location.

Since its inception through 2022, over 1,800 nutrition staff and others affiliated with school meals have graduated from virtual and in-person PSU programs (USDA FNS, 2025).

In 2023, Texas Tech University (TTU) faculty with expertise in food safety (produce production, processing, and foodservice), agriculture education, and adult learning began a Cooperative Agreement with USDA to conduct a mixed-methods, evidence-based evaluation of PSU. One major question in the evaluation was to identify the reported knowledge, confidence, and the impact of the PSU program on behavioral and practical change, which is the focus of this article. Data were gathered from program participants since 2018, recognizing that job changes and retirements were likely with graduates from earlier years. That recall of requested information would be greater with recent graduates.

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METHODOLOGY:

Human Safety Approval

The Texas Tech University Institutional Review Board (Protocol No: IRB2023-817) granted exempt approval to conduct the study. As part of the exemption status of this research project, personal identifying information, such as participant name, street address, phone number, or email address, was not collected for analysis. As part of the human subject approval, participants can answer as few or as many questions as they like in the survey. The number of respondents is included in the tables for each result.

Population Surveyed

The population of PSU graduates evaluated in this research was from the classes of 2018, 2019, 2021, 2022, 2023, and 2024 (N=766). A survey was emailed and mailed to the first set of PSU graduates from 2018, 2019, 2021, 2022, and 2023 (N=632) and only emailed to the cohort from 2024 (N=134) following the 2024 PSU workshops due to the cost of mailing and low return rate of mailed surveys from the initial deployment. All emails and/or mailing addresses were provided by the USDA PSU administrator.

Data Collection Instrument

Email and mailed surveys contained the same demographic and impact questions (55 questions). Participants were asked to provide information about their education, work experience, and school district characteristics. To assess the impact of PSU, questions about the training related to fresh produce safety, knowledge changes, confidence levels, and training and production behaviors were included. Survey instruments were designed to be completed in approximately 30 minutes and included a variety of response options (multiple choice, select from, open-ended, and Likert-type rating scales). Rating scales had three, four, or five points with a Not Applicable option included.

Piloting of Survey

Pilot testing of the survey instrument was conducted with a sample of PSU graduates from the 2017 cohort (n = 31). An initial email notification of the survey was sent to provide the purpose of the survey. Two days later, a second email was sent with an embedded survey link and QR code included. After seven days, and then again fourteen days after the second email, reminder emails were sent to complete the survey. A final email was sent on day 21 to indicate a notice of the pilot survey closing. While the pilot data was being collected, two subject matter experts assisted in the evaluation of the survey. Pilot data were reviewed for construct, content, face, and criterion validity using the methodology outlined in Fink (2010). In brief, we evaluated construct validity through expert review to verify that each item accurately represented its intended theoretical construct. Content validity was assessed by having experts judge items for relevance, clarity, representativeness, and essentiality. Face validity was examined through expert review and pilot testing to determine whether items appeared appropriate and understandable and whether any key content was missing. Criterion validity was assessed by comparing pilot results with established measures and prior research findings. As a result of the pilot study results, several questions were rephrased due to questions failing the construct validity testing.

Data Collection

Survey instruments were sent to PSU graduates from 2018 to 2023 (excluding the year 2020, as no classes were held) in the spring of 2024, and to 2024 PSU graduates in the fall of 2024, approximately six months following completion of the PSU classes that year. The same protocol used for pilot testing was followed for survey dissemination.

Data Analysis

The data presented is a subset of a greater dataset that explored Adult Learning Theory and the differences in modality of the PSU course. Data were imported from the Qualtrics survey system into the Statistical Package for the Social Sciences (SPSS) (version 31) and Python in Google Colab (version 3.11). Due to the exemption for human subjects, PSU graduates could provide information as they desired, which is why the number of respondents to survey items varied (U.S. National Science Foundation, 2025). Missing responses to survey questions were omitted from calculations.

The scale of measurement for each variable (nominal, ordinal, interval, and ratio) was identified to ensure appropriate statistical analysis. Descriptive statistics, including frequencies, means, and percentages, were calculated using SPSS. Python in Google Colab was used for Likert-scale questions and "check all that apply" questions. Survey responses were scored numerically: 1 = Increased ("increased somewhat" and "increased significantly"), 2 = "no change", 3 = Decreased "decreased somewhat" and "decreased significantly"), 4 = "not applicable". One (increase) is reported in frequency. For questions with a 'check all that apply' format, each option selected by a respondent was treated as a yes response, and frequencies and percentages were calculated by splitting the responses, cleaning the text, and counting the number of respondents selecting each option.

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RESULTS AND DISCUSSION:

Of the 766 graduates who attended PSU between 2018 and 2024, 67 total contacts were unreachable, as 45 of the email addresses were invalid, and 22 mailed surveys were returned to sender. Data from the mailed survey instruments were added manually to the data set for statistical analysis. A total of 148 of the 699 graduates who received the survey filled in at least part of the questionnaire for a response rate of 21.2%. This response rate is consistent with past research, as noted by Sauer et al. (2021). The average email-based response rate for school nutrition specialists ranged from 10 to 40% (Sauer et al., 2021), and according to the research of Wu et al. (2022), who concluded in a meta-analysis of online surveys in the education field, an average response rate of 44.1%. Other researchers have noted that response rates with school districts are as low as 16% (Boutros et al., 2019; Grisamore & Roberts, 2014; Roberts et al, 2018).

Demographic profiles of PSU graduates who responded to the surveys are shown in Table 1. Of the 90 respondents reporting work experience, 34 (37.8%) had more than 15 years of experience in child nutrition programs, while 45 (50%) indicated they had 5–14 years of experience in school foodservice. Child nutrition programs now include six generations in their workforce, marking a significant demographic shift. This mirrors broader national trends noted by Pearce (2024), who reported that six generations are currently represented in the U.S. workforce. Compared to the four generations identified by Strohbehn et al. (2014), this expansion highlights the need for updated management and training approaches to support a more diverse staff.

Fifteen of the 88 respondents who provided enrollment information were from schools with over 19,000 students, while 35 worked in districts with 2,500 to 19,000 students. There has been a long-term trend in the U.S. toward consolidating smaller, rural school districts into larger, "mega" school districts, driven by arguments of cost-efficiency, as Schmidt and Schlottmann (2024) noted that the number of school districts had fallen from over 200,000 in 1910 to under 14,000 by the early 2020s. This movement toward larger school districts has continued; thus, school nutrition program administrators' knowledge and skills as they make food quality and safety decisions related to procurement, preparation, and service impact more students. Of these 88 respondents, 11 had not worked directly in child nutrition programs, noting employment areas such as Farm to School or a State Agency, suggesting potential influence over multiple school districts.

Of the 84 respondents who identified their educational level, 56 (66.6%) had earned bachelor's degrees, with 22 of these respondents having completed a master's degree. Other respondents to this question indicated some college credit had been earned (n=14) or trade/vocational training completed (n=4). Professional standards identified by the USDA for School Food Authorities include requirements that school meal program directors have an earned college degree or 10 or more years of experience in school nutrition for districts with enrollments of over 10,000 students (USDA FNS, 2021). In addition, recent versions of the FDA's Model Food Code require the PIC to have completed food safety training (FDA, 2022). Respondents indicated the food safety training they received, selecting multiple options. Of the 88 who responded, 70 (79.5%) had completed the ServSafe® Course, and/or over 50 had also completed a college course in food safety or food science (61.4%) or a course from the Institute of Child Nutrition (ICN) (56.8%). ServSafe® is the National Restaurant

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Association's widely used program offering training and certification in food safety for foodservice managers and staff that is approved by the Conference on Food Protection as meeting the Food Code's food safety knowledge requirement for the PIC (ServSafe®, 2025; The Conference for Food Protection, 2025).

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Table 1. *A Profile of PSU Graduate Survey Respondents who attended in 2018, 2019, 2021, 2022, 2023, or 2024*

Characteristics	Total Responses (N)	Frequency (n)	Frequency percent (%)
Total number of years respondents reported employment within a child nutrition program.	90		
More than 15 years		34	37.8
11–15 years		22	24.4
6–10 years		23	25.6
0–5 years		11	12.2
School district size	88		
Medium (2,500–19,999 students)		35	39.8
Small (less than 2,500 students)		27	30.7
Not employed in a school district at the time of attendance.		11	12.5
Large (19,000–39,999 students)		10	8.8
Mega (400,000 or more)		5	5.7
Highest Level of Educational Preparation	84		
Bachelor's degree		34	40.4
Master's degree		22	26.2
Some college credit earned		14	16.7
Associate degree		9	10.7
Trade/technical/or vocational training		4	4.8
I don't wish to answer.		1	1.2
Food safety training received[a]	88		
College course credit in food safety, food science, food production, or other		54	61.4
ServSafe® Course from the National Restaurant Association		70	79.5
Food safety presentations at conferences or training (1 to 4 hours in length)		63	71.6
Completion of the Institute of Child Nutrition Course		50	56.8
Serving Up Science (from the Center for Food Safety in Child Nutrition Programs at Kansas State University)		16	18.2
HACCP workshops		11	12.5
ProSafe® from the National Restaurant Association		5	5.7
National Environmental Health Association Foodservice Certification		2	2.3
Other (please identify)		2	2.3

[a] Reflects the number of respondents who selected the answer. Respondents could select all that applied. Due to human subject approval, the participants could answer as much or little of the survey as they wish.

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Impact

The impact of PSU included the training graduates had provided to others and reported changes in knowledge, confidence, and behaviors. Table Two shows these reported impacts.

Table 2. *Impact of Produce Safety University to Child Nutrition Specialists Who Graduated From the Course in 2018, 2019, 2021, 2022, 2023 or 2024.*

Impact	Total Responses (N)	Frequency (n)	Frequency percent (%)
Training others in Produce Safety			
PSU graduates indicated that they had provided training on at least one of the PSU topics[a]	99	83	83.3
Those who provided training indicated reasons that they did so because there was a perceived need within the school district for nutrition program staff to have this information[b]	99	64	64.6
Effectiveness of training materials when PSU graduates trained others[a]	99	54	54.5
Those who provided training indicated reasons that they did so because there was a need for other school staff to understand produce safety[b]	99	28	28.3
Lack of time was seen as a barrier for training others[b]	99	10	10.1
Knowledge Gained			
Gained knowledge of identifying food safety risks with fresh produce along the supply chain [c]	100	93	92.9
Gained higher knowledge about correct produce safety practices [c]	72	63	87.5
Gained knowledge to correct improper produce safety practices [c]	73	63	86.3

[a] Yes or no question. Only Yes responses are reported.

[b] Check all that apply was the response option. Percentages are based on the number responding to each question.

[c] 1 = Responses are for those who reported changes had increased, increased somewhat, or increased significantly. Only increases are reported.

(Table 2 continues)

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Table 2 (continued). *Impact of Produce Safety University to Child Nutrition Specialists Who Graduated From the Course in 2018, 2019, 2021, 2022, 2023 or 2024.*

Impact	Total Responses (N)	Frequency (n)	Frequency percent (%)
Confidence Gained			
Gained confidence to correct unsafe behaviors with fresh produce [c]	75	73	97.3
Gained confidence in correcting improper produce safety practices [c]	74	67	91.0
Gained confidence in writing produce specifications [c]	54	42	77.5
Higher comfort level with rejecting fresh produce items at delivery that didn't meet their specifications [c]	72	55	76.4
Higher comfort level with writing produce specifications [c]	64	43	68.8
Gained confidence in correcting the safety of produce from the school garden [c]	76	30	39.5
Behavioral/ Practices Changed			
Graduates indicated they were able to identify potential produce safety issues [c]	69	64	93.0
Reported they had improved food handling and service practices [c]	102	84	82.3
Reported they had made changes in communicating with produce suppliers about the quality and condition of produce [b]	60	49	81.7
Reported they had made changes in communicating with produce suppliers about delivery conditions [b]	60	45	75.0
Reported they had made changes in communicating with produce suppliers about temperature controls [b]	60	44	73.3
Graduates indicated they were able to make changes to improve receiving, storage, preparation, or service practices [c]	99	68	68.7

[a] Yes or no question. Only Yes responses are reported.

[b] Check all that apply was the response option. Percentages are based on the number responding to each question.

[c] 1 = Responses are for those who reported changes had increased, increased somewhat, or increased significantly. Only increases are reported.

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Table 2 (continued). *Impact of Produce Safety University to Child Nutrition Specialists Who Graduated From the Course in 2018, 2019, 2021, 2022, 2023 or 2024.*

Impact	Total Responses (N)	Frequency (n)	Frequency percent (%)
Behavioral/ Practices Changed			
Reported they had made changes in communicating with produce suppliers about packaging information [b]	60	36	60.0
Reported they had made changes in communicating with produce suppliers about produce safety in general [b]	60	44	58.8
Reported less produce waste in the kitchen because of PSU [c]	99	55	55.6
Reported they had made changes in how they sourced fresh produce [b]	99	55	55.5
Reported they had made changes in communicating with produce suppliers about worker/student health and hygiene practices [b]	60	33	55.0
Reported that they had created or improved written produce specifications [b]	100	53	53.5
Reported they had made changes in communicating with produce suppliers about traceability documentation [b]	60	30	50.0
Reported an increase in the number of local producers providing fruits and vegetables [c] to their programs that are GAP certified	19	9	47.4
Reported an increase in the volume of local growers used [c]	53	24	45.2
Reported they had made changes in communicating with produce suppliers about on-farm food safety documentations [b]	60	25	41.7
Reported developing new procedures in preparation of fresh produce [b]	60	22	36.7
Graduates indicated they were able to create new farm to school activities [b]	73	24	32.9

[a] Yes or no question. Only Yes responses are reported.

[b] Check all that apply was the response option. Percentages are based on the number responding to each question.

[c] 1 = Responses are for those who reported changes had increased, increased somewhat, or increased significantly. Only increases are reported.

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Table 2 (continued). *Impact of Produce Safety University to Child Nutrition Specialists Who Graduated From the Course in 2018, 2019, 2021, 2022, 2023 or 2024.*

Impact	Total Responses (N)	Frequency (n)	Frequency percent (%)
Behavioral/ Practices Changed			
Reported they had made changes in communicating with produce suppliers about GAPs [b]	60	17	28.3
Reported staff monitoring fresh produce inventory [b]	60	17	28.3
Collaborated with other PSU graduates after attending [a]	86	24	27.9
Reported they had an increase in volume of purchases or use of product from distributors, or school gardens [c]	55	12	21.8
Reported staff washing unprocessed fresh produce [b]	60	12	20.0
Reported staff monitoring self-service fruit and vegetable bars [b]	60	9	15.0
Reported staff developing storage protocols [b]	60	8	13.3

[a] Yes or no question. Only Yes responses are reported.

[b] Check all that apply was the response option. Percentages are based on the number responding to each question.

[c] 1 = Responses are for those who reported changes had increased, increased somewhat, or increased significantly. Only increases are reported.

Training Others. One of PSU's intentions was to be a train-the-trainer course. Of the 99 graduates who responded to the question about providing training on one or more topics about produce safety since completing the course, 83 (83.3%) indicated they had done so, reporting this was done because of a perceived need within their district for school nutrition staff to have this information (n=64) or for other school staff to understand produce safety (n=28). An average of 5.4 classes were taught with around 30 attendees at each. Those who had trained noted the PSU Binder and other materials provided during the course were helpful (n=54). Lack of time was most frequently cited as a barrier to training others (n=10); most respondents indicated they felt prepared to train others (n=101).

Knowledge. Over 90% of respondents said they had gained knowledge about identifying food safety risks from fresh produce (n=93; 92.9%). Of these, 63 noted a gain in knowledge to correct unsafe produce practices. Research has shown that in-depth knowledge about the produce industry can help shape graduates' attitudes and beliefs about food safety along the supply chain, which supports their self-regulation and affects

behavioral change (Roberts et al., 2020; Ryan, 2009; Lorig, 2003). Although knowledge by itself is not sufficient, it is a crucial first step that supports self-regulation, builds understanding of important health and social issues, and increases the likelihood of taking action (Arlinghaus & Johnston, 2017).

Confidence Gained. Of the 75 participants who answered questions about changes in produce safety practices, 73 reported their confidence in correcting unsafe behaviors with fresh produce had increased either "significantly" or "somewhat". Similarly, 67 noted "significant" or "somewhat of an increase" in confidence when correcting improper produce safety practices, and 30 reported similar increases in confidence in correcting the safety of produce from school gardens. A 2018 joint position statement from the Academy of Nutrition and Dietetics, the Society for Nutrition Education and Behavior, and the School Nutrition Association promoted school gardens as part of a multidisciplinary strategy to improve children's nutrition (The Academy of Nutrition and Dietetics, the Society for Nutrition Education and Behavior, and the School Nutrition Association, 2018). Ensuring confidence in safe gardening practices is therefore essential as school gardens are used by many teachers as a form of experiential learning, and it is not uncommon for produce from these gardens to be used in school meals or for students to influence garden practices at home. Respondents also noted higher confidence (n=42) and greater comfort level (n=43) with writing produce specifications. Written specifications are a tool used by the buyer to communicate with a product supplier about their purchasing needs. Fresh produce suppliers may include a wholesale operation or a local grower, including school gardens. Of the 75 respondents, 55 indicated they now had a higher comfort level with rejecting delivered fresh produce items that did not meet their specifications.

Behavior Changes. The Theory of Planned Behavior proposes that behavior is driven by intention, which is influenced by attitudes, subjective norms, and perceived behavioral control (PBC). Together, these factors shape intention, the strongest predictor of actual behavior. Roberts et al. (2020) applied TPB to food safety in school nutrition programs, finding that knowledge alone was insufficient; attitudes, norms, and PBC also played key roles in shaping employee behaviors. Our findings showed graduates reported making changes to improve the receiving, storage, preparation, or service of fresh produce to strengthen food safety controls (n = 68), with 84 specifically noting improvements in handling and service practices. Because of PSU, 55 participants reported less waste of produce in the kitchen. Unnecessary product waste can lead to menu shortages and increased costs. School nutrition programs strive to serve quality foods in an economical manner. Waste from produce can be caused by damage (e.g., bruising) or a lack of training in the correct fabrication of the item, such as excessive trimming of peels. Other notable reported changes included communications with produce suppliers about produce safety in general (n=60), quality and condition of produce (n=49), temperature controls (n=44), packaging information (n=36), worker/student health and hygiene (n=33), traceability documentation (n=30), on-farm food safety documentation (n=25), and Good Agricultural Practices or GAPs (n=17). With increasing interest in Farm to School activities, buyers of fresh produce for school meals must ensure these items are safe for consumption. Behavior changes noted in communicating with produce suppliers, as well as changes reported as made in the foodservice operation, highlight efforts to mitigate these potential risk factors.

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CONCLUSIONS AND APPLICATION:

Survey feedback from PSU Graduates since 2018 shows the knowledge, confidence, and behavioral/ practice change impact of the course is positive (n=148). Results highlight a variation in characteristics of child nutrition program staff with multiple generations responding to the survey; educational backgrounds ranging from high school diploma to a doctoral degree; experience working in school meals from less than a year to more than 15 years; and district enrollments of fewer than 2,500 students to more than 400,000. PSU provides a professional development opportunity that reaches participants with wide variations in age, educational, and environmental traits. This information can be used by school districts when considering training practices for their employees (Strohbehn et al.,2014).

The curriculum was envisioned as a train-the-trainer model to empower child nutrition professionals at all levels to disseminate ways to keep produce safe in school nutrition programs and ensure students are served nutritious food. Train-the-trainer models have been shown across disciplines to be cost-effective and efficient at disseminating information to cause significant changes (Pearce et al., 2012; Suhrheinrich, J., 2011). Graduates responding to our surveys felt prepared to provide training, and most did so, due to a perceived need for school nutrition professionals to have this knowledge, as well as others in the district, such as teachers using a school garden as part of classroom instruction. Resources (such as PowerPoint handouts and activity guides) provided to PSU participants through an online portal were reported as frequently used in the training they provided. With an average of 5.4 classes taught by graduates, the impact of PSU is expanded to reach broader audiences. Those who did not provide any training cited a lack of time as the primary barrier. These results are significant as 14.5% of the respondents are from larger school districts that have more staff to train; thus, additional impacts of the program, including improved safety and quality of produce in school meals, could be seen with increased time to provide training.

Our data was collected following the passage of the FSMA Produce Safety Rule that established requirements for fruit and vegetable growers, although small-scale local farms, which are typical suppliers as part of Farm to School activities, are exempt (FDA, 2024). Respondents reported they had gained *knowledge* about food safety along the fresh produce supply chain, *confidence* in improving practices such as writing specifications, and had made changes in *practices* when communicating with suppliers about on-farm food safety, worker health and hygiene, and traceability documentation. These reported changes in practice when communicating with suppliers, coupled with training provided to district employees not working in school nutrition, provide assurances that Farm to School activities involving fresh produce can be safely implemented. As interest in local food systems continues to grow, school nutrition program administrators are often asked to participate in some type of Farm to School activity, such as using school garden produce in school meals (Bobronnikov et al, 2021). Ensuring safe practices are followed in the garden (during production, harvest, and post-harvest handling) before items are delivered to kitchens is the responsibility of the PIC of the nutrition program, who will establish policies and procedures to guide safe practices. Graduates of PSU are equipped to identify and implement standard operating procedures to protect the nutritional integrity and safety of items served in school meals, as they have the knowledge and confidence about risk mitigation strategies to ensure the safety

of produce from farm to fork. Findings are consistent with past research highlighting that knowledge, attitudes, and behavior are essential recipe ingredients to improve food handling behaviors, as knowledge alone, while the essential first step, is not sufficient, and that Farm to School Coordinators relied on school nutrition staff to communicate safe handling information (Paez et al., 2024; Roberts et al., 2020).

The PSU curriculum was designed to provide knowledge about the produce industry from production to service, thereby influencing their attitudes and beliefs about food safety along the supply chain, which in turn affects behavioral change (Roberts et al., 2018). This knowledge base serves as the foundation for improving the safety of fresh produce served in schools. The content of PSU is more extensive than that presented in typical food safety trainings, such as ServSafe®, the widely used program administered by the National Restaurant Association and one frequently cited by participants as having completed (ServSafe, 2025). The PSU course involves lectures and experiential learning in the form of videos, field trips (for in-person sessions), and hands-on lab sessions (Produce Labs). Thus, multiple learning styles are addressed in the course and serve to influence participants' attitudes about the importance of safe produce. This study found that participants reported behavior changes to improve the safety of fruits and vegetables served in their operations due to the knowledge and confidence gained in PSU. Trainers have strong subject matter expertise on links of the supply chain from production to service and excellent communication skills, with many being knowledgeable about school nutrition programs. Scripted presentations and videos are available on the PSU online portal, which is open to PSU graduates for six months after training, or on the ICN website. Hard copies of most materials, including the PSU Binder, are given to participants at in-person sessions. These attributes of PSU include many of the elements used in evidence-based train-the-trainer models, such as those developed by CDC or the ICN: adult learning principles, expert trainers, emphasis on practical applications, a feedback system for skill development, comprehensive training materials, and ongoing support. A trainer manual (called Protype) was recently developed by the PSU training team and is provided to participants as a tool for training. Protype incorporates many of the elements noted as best practice with train-the-trainer models. These educational tools can be a great asset to any school and/or school district as they plan their professional development activities. Future research could assess the effectiveness of the trainer manual tool to promote knowledge and behavioral change, along with actual knowledge gains of participants, through analysis of pre- and post-PSU assessments using the course materials.

Completion of PSU has shown to be an impactful program for child nutrition professionals and has resulted in positive self-reported knowledge, confidence, and behavior changes that have impacted the safety of produce within attendees' school districts and beyond through additional training with other interested audiences. School nutrition staff are usually the district employees with the greatest knowledge about food safety and risk mitigation from unintentional and intentional contamination of food. Data from The Food Research and Action Center (Hayes & FitzSimons, 2025) shows increases in school breakfast (8 percent) and lunch (6.8 percent) from the 2022–2023 to 2023–2024 school year. As school nutrition programs expand, school meal program staff have an increasingly important role in addressing food insecurity and ensuring food is properly handled from farm to fork.

Results suggest PSU administrators continue virtual and in-person course options to support a diverse workforce, offer mentorship or mock training opportunities as part of continued education, and increase the amount of curriculum available for training others. It is also recommended that PSU consider including the expectation for participants that a minimum number of training sessions on one or more PSU topics be provided.

Limitations to the Study

The authors acknowledge that there are benefits and limitations of utilizing self-reported survey data results. Self-reported data may be less accurate due to the inaccuracies of recall bias, participants not fully understanding questions, and deliberate or unintentional under-reporting or exaggeration (Świątkowski et al., 2025). To improve content validity, researchers utilized a pilot study of the 2017 PSU graduates to validate and improve the survey tool to minimize these conflicts.

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ABSTRACT

PURPOSE/OBJECTIVES

The purpose of this study was to assess the impact of a program called "Produce Safety University" (PSU) on participants' reported knowledge, confidence, and behavior change about fresh produce used in their school meals program.

METHODS

Data were collected from graduates of PSU from classes held from 2018 to 2023 (except for 2020 due to COVID cancellation) via online and mailed surveys, while an online-only survey was sent to graduates of 2024 (due to the low return rate of mailed surveys in previous years). The survey was designed to be completed in ~30 minutes. Demographic information (i.e., educational level, food safety training, employment length, and school district size) about participants and their workplace was collected. Participants were asked about the training they provided to other school nutrition staff on produce safety, their perceptions of the knowledge and confidence gained, and any changes reported in their practices as a result of attending PSU. Descriptive statistics were determined (frequencies, means, and percentages).

RESULTS

Participants represented a wide range of educational backgrounds, experience working in school meals, and the size of the school district. Most (83.3%) had provided training about produce safety for school nutrition staff or others within the district because of a perceived need (64.6%). The majority indicated they had gained knowledge (92.9%) and confidence (97.3%) about produce safety from production to service and reported they had implemented changes in food safety practices related to purchasing, preparation, and service as a result of attending PSU (58.8-82.3%).

APPLICATIONS TO CHILD NUTRITION PROFESSIONALS

Produce Safety University is an immersive, fresh-produce safety course designed to help districts meet fruit-and-vegetable meal requirements and support Farm to School efforts by building participants' ability to identify food-safety risks along the produce supply chain, apply correct produce-safety practices, and recognize and correct improper practices to keep food safe from farm to fork.

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