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Teaching Methods and Tools Used In Food Safety Extension Education Programs in the North Central Region of the United States

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Abstract

One of the ways to ensure food safety is to educate the public. Of the organizations providing food safety education in the United States (U.S.), the Cooperative Extension System (CES) is one of the most reliable. The effectiveness CES programs depends not only on what is being taught but also on how it is taught. Both a needs-based curriculum and how that curriculum is delivered are equally important. This descriptive cross-sectional study using a disproportional stratified random sample identified the teaching methods and tools being used by food safety extension educators of the CES of North Central Region (NCR). A Likert-type scale administered to extension educators revealed that they were adopting a balanced use of teaching methods and tools, and using learner-centered teaching methods in their programs. However, distance education, case studies and podcasts, which are commonly used in education programs, were not being used extensively. We recommend that food safety extension educators of NCR should increase the use of these two teaching methods and tool while continuing to use the current ones. This study has implications for improving food safety education delivery to clients in the NCR and for designing inservice education for food safety extension educators.

Keywords:
Food safety education, extension educators, teaching methods, and teaching tools.

List of Abbreviations Used
CES: Cooperative Extension System
NCR: North Central Region
FCS: Family and Consumer Sciences
ANR: Agriculture and Natural Resources

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INTRODUCTION

Food safety is an important national and global concern with serious health and trade implications. Ensuring the safety of food is a challenging task to governments despite rigorous regulatory practices. The incidence of food-related illnesses is increasing throughout the world (Motarjemi & Kaferstein, 1999), and foodborne illnesses represent a major health threat in all countries, from the most to the least developed (De Waal & Robert, 2005). In 2005 alone, 1.8 million people died of diarrheal diseases caused due to lack of food and water safety worldwide (World Health Organization (WHO), 2007). In the United States (U.S.), every year, one in six Americans suffers a foodborne illness with 48 million reported cases of foodborne diseases resulting in 128,000 hospitalizations and 3,000 deaths (Centers of for Disease Control and Prevention, 2011).

Food is needed for survival, but "Eating could very well be called America's national pastime" (Pennsylvania Impact, 1999, p.1). To ensure that public gets safe food, the American government invests vast sums of money and effort; yet, food-related illnesses remain prevalent (Ellis, 2006; Nyachuba, 2010). Aside from health, foodborne illnesses also have severe economic implications. A single outbreak of a foodborne illness in a metropolitan area can cause losses of up to $7 million for a chain of foodservice operations (Guion *et al.,* 2004). For a small business one such outbreak could challenge its very survival (Guion *et al.,*). Consequently, food safety is a legitimate problem in the U.S. (Barton & Barbeau, 1992). One of the ways to address this problem is to educate public on food safety.

It is found that the average American is not knowledgeable about food safety (Altekruse *et al.,* 1995). Consequently, effective food safety education programs are needed (Nyachuba, 2010). Of the organizations that offer food safety educational programs in the U.S., the Cooperative Extension System (CES) is considered the most reliable owing to its research support from land-grant universities (Feller *et al.,* as cited by McDowell, 2001). CES's reliability is further validated by research findings that indicate the impact of CES's food safety educational programs in bringing about changes in food safety behaviors (Gentry-Van Laanen & Nies, 1995; Wardlaw, 1999), improvement in knowledge (Laminack *et al.,* 2008), and adoption of recommended food safety practices (Dean *et al.,* 2008).

The effectiveness of such education programs conducted by the CES depends not only on what is being taught but also on how it is taught. Hence, a needs-based curriculum alone cannot ensure the success of an educational program but how that curriculum is delivered to clients is equally important. Cole (1981) stated that the primary role of extension educators is teaching, which means that they should learn more about the teaching methods and tools they use in their educational programs (Jayaratne & Martin, 2003). Further, Apantaku *et al.,* (2008) found that the teaching methods used by extension educators have an effect on the clients' outcomes. In addition, food safety has been identified as a scientifically complex subject matter whose underlying principles are not properly understood by the general public (Barton & Barbeau, 1992). Therefore, selection of appropriate teaching methods and tools is essential for conducting effective food safety education programs.

Verner (1959) stated that the methods used in an educational program indicate the ways in which people involved with the program are organized, and that it also establishes a relationship between learners and the agency offering the educational program (as cited by Conti & Kolody, 2004). He further stated that certain devices

(identified as teaching tools in this study) facilitate the learning. Conti and Kolody stated that proper selection of methodology in the teaching-learning process results in professionalism, which contributes to the overall quality of the information being delivered. Therefore, food safety extension educators must give due consideration to the teaching methods and tools they use in their educational programs. This study identified and analyzed the teaching methods and tools being used by extension educators of the 12 member states of the North Central Region (NCR) of the U.S. in their food safety educational programs. There are no other known research studies that have analyzed the teaching methods and tools used in food safety extension programs in the CES of NCR.

PURPOSE AND OBJECTIVES

The purpose of this study was to identify and analyze the teaching methods and tools used by food safety extension educators of the NCR of the U.S. The study had the following objectives:

1. To identify the demographic characteristics of extension educators,
2. To identify the extent of use of the selected teaching methods by extension educators, and
3. To identify the extent of use of the selected teaching tools by extension educators.

MATERIALS AND METHODS

This study adopted a descriptive cross-sectional survey design. The population for this study was all the County Extension Directors (CEDs) and all extension educators in the program areas of Family and Consumer Sciences (FCS) and Agriculture and Natural Resources (ANR). CEDs were included because most had job responsibilities in more than one program area. While 4-H extension educators offer food safety educational programs to youth, they were not included as this study focused primarily on adult educational processes.

A disproportional stratified random sample was drawn from the total population. The formula for calculating sample size as suggested by Ary *et al.,* (2006, p.419) was used to arrive at a sample size of 384. Anticipating a 50% return rate (Ary *et al.,*), 64 extension educators were randomly selected from each of the 12 member states of the NCR yielding a sample size of 768. The 12 member states of the NCR include Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin. An electronic questionnaire developed using SurveyMonkey® and modeled on questionnaires used by Creswell (1990), Jayaratne (2001), Kwaw-Mensah (2008), and Walczyk and Ramsey (2003) was used for this study. This format for the survey questionnaire was used because the researchers had previous success conducting a similar study with agriculture teachers (Koundinya & Martin, 2010).

A list of 12 teaching methods and 14 teaching tools was developed based on a review of literature that focused on extension educational processes in livestock waste management, sustainable agriculture, water quality management and private pesticide training, and also based on input from Extension experts at the Iowa State University. The identified teaching methods and tools depicted those most commonly used in typical extension programs in the NCR. Additionally, a provision was given to extension educators to identify any additional teaching methods and tools they were using in their food safety educational programming. The extent of use of different teaching methods and teaching tools was identified on a Likert-type scale that ranged from 0 = Not Used (NU) to 4 = Always Used (AU).

The questionnaire was validated by an expert panel for face and content validity. The panel consisted of professors from the departments of

agricultural education, food science and human nutrition; CES state program leaders in the program areas of FCS and ANR; and the Director of Extension at the Iowa State University. The questionnaire was pilot-tested with extension educators, and the resulting data was used to establish the reliability of the questionnaire. The extension educators that participated in the pilot test were excluded from the survey population to prevent a contaminated sample. For reliability of the questionnaire, Cronbach's α was computed from the pilot test data. Values of .768 and .893 were reported for teaching methods and tools sections, respectively, which are categorized as "acceptable" and "good" reliability, respectively, by George and Mallery (2003).

Selected extension educators were emailed a letter informing them the purpose of this research study. This letter sought their cooperation, and it was made clear that their participation in this study was voluntary and that they could withdraw at any time. They were also informed that any changes in the study's objectives would be communicated to them. Extension educators did not receive any monetary incentive for participating in this study. After this introductory email, the survey questionnaire was emailed to them. Extension educators' consent for the study was assumed if they filled out and returned the questionnaire. Four follow-ups were conducted at suitable time intervals. This study was a part of a bigger study that focused on the food safety educational processes in the CES of NCR of the U.S.

A potential limitation to this study was a comparatively lower response rate. According to Linder, Murphy, and Briers (2001), any response rate of less than 85% could result in significant differences between early and late respondents, thus affecting the external validity of the study. One method to account for nonresponse error is to compare early and late respondents (Dooley & Lindner, 2003; Miller & Smith, 1983). An independent samples t-test was conducted for comparing early and late respondents, and no statistically significant differences were recorded on the extent of use of all teaching methods and tools, except on use of the following tools: PowerPoint®, posters and videos. Late respondents had significantly higher mean scores than the early respondents on the extent of use of PowerPoint® and posters, whereas early respondents recorded significantly higher scores on the extent of use of videos in their food safety educational programs. Therefore, it was decided not to generalize the findings on these items to non respondents and the total population.

RESULTS AND DISCUSSION

Four hundred sixteen of the 768 extension educators responded to the survey for an initial response rate of 54.16%. However, only 325 questionnaires were usable, yielding a response rate of 42.31%. The findings for each objective are presented below.

Objective 1: To identify the demographic characteristics of extension educators

The respondents had a work experience of 14.86 years on an average, with a standard deviation (SD) of 10.04. Work experience ranged from 1 to 40 years. The respondents ranged from 24 to 73 years of age. The mean age of the respondents was 48.62 years with a SD of 10.85. Since outliers were detected in the age distribution, a median was calculated to account for the skewed data. The median age of the respondents was 51 years, indicating a negatively skewed age distribution. Of the respondents, 56% were female and 61.88% had earned a master's degree.

The demographic distribution was in line with the findings of Camara (2006); Creswell (1990); Jayaratne (2001); Kwaw-Mensah (2008); Radhakrishna and Thomson (1996) regarding de-

mographic characteristics like age, educational level, and work experience; and with the findings of Webster *et al.,* (2001) regarding age, but differed in gender distribution. All these six studies found that a majority of the extension educators who participated in their studies were males. Braiser *et al.,* (2009), and Selby *et al.,* (2005), however, found that a majority of extension educators in their research samples were females. This difference could have been due to the differences in the states in which extension educators were working.

Objective 2: To identify the extent of use of the selected teaching methods by extension educators

The mean and standard deviation data on the extent of use of teaching methods by extension educators indicated that discussion (M = 2.88) was the most used among the 12 identified teaching methods followed by demonstration (M = 2.76) and lecture-discussion (M = 2.62), whereas learning contracts was the least used method (M = 0.57) followed by distance education (M = 1.35), quizzes (M = 1.46), and case studies (M = 1.79) (Table 1).

Kwaw-Mensah (2008) found discussions and lecture-discussions to be among the more commonly used teaching methods by extension educators of the NCR in livestock waste management education. On a similar vein, Shinn (1997) found that in the U.S., teachers of agriculture used demonstrations more often followed by discussion. From the learners' perspective, Reisenberg and Gor (1989) found that farmers preferred demonstrations to learn about innovations. Discussion has been identified as an inclusionary and participatory teaching method that facilitates critical thinking skills in learners (Brookfield, 2004), which is an essential component for teaching safe food practices and behaviors. Also, this teaching method is the most respectful of learners, and places the educator and learners on equal footage as it assumes that everyone has a useful contribution to make to the educational program (Brookfield). Subsequently, discussion is identified as a learner-centered teaching method (Jarvis, 2004).

Table 1: Mean and standard deviation scores of extension educators based on the extent of use of teaching methods in food safety education programs

S. No	Teaching method	M	SD	n
1	Discussion	2.88	0.90	321
2	Demonstration	2.76	0.90	320
3	Lecture-discussion	2.62	0.99	318
4	Lecture	2.51	1.07	320
5	Questioning	2.44	1.07	316
6	Small group work	2.16	1.06	316
7	One-on-one instruction	2.12	1.18	320
8	Problem Solving	2.10	0.98	317
9	Case Studies	1.79	1.04	320
10	Quizzes	1.46	1.16	315
11	Distance Education	1.35	1.09	315
12	Learning Contracts	0.57	0.92	305

Scale used: 0= Not Used, 1= Rarely Used, 2= Sometimes Used, 3= Frequently Used, 4= Always Used.

Demonstrations have their own significance for teaching skills by providing hands-on learning experiences. One of the basic principles in extension work is 'learning by doing' (Reddy, 1993) and the doing part is well provided by demonstrations. Essential specific skills related to safe food practices can be readily learned by demonstration. From the extension educators' perspective, demonstrations make economical use of time, equipment and materials (Gilley, 2004). Similarly, lecture-discussions have their own unique role to play in food safety education. A brief lecture for identifying and clarifying concepts is necessary in educational programs (Farrah, 2004). There are some complex scientific facts that learners need to know about food safety (Barton & Barbeau, 1992), and a brief lecture before opening the floor for discussion can accomplish that purpose.

Furthermore, it was found that none of the teaching methods were "Frequently Used" or "Always Used." This might suggest that food safety extension educators in the NCR were not

relying excessively on any one particular method, and thereby adding variability to the adult education settings (Garton, 1999). Lynn (1996) suggested that a variety of strategies should be used in food safety educational programs (as cited by Costello *et al.,* 1997). The use of multiple teaching methods is also supported by Hall *et al.,* (2004); Ota *et al.,* (2006); and Rodewald (2001).

On the other hand, Shinn (1997) found that learning contracts, distance education and case studies were not being used much by agricultural educators in the U.S. which is in line with the findings from this study. Berger *et al.,* (2004) suggested that learning contracts can be used in a variety of settings with diverse adult learners. Also, they indicated that learning contracts are useful in the acquisition of skills as well as content, and they can be individualized to the learners. But, learning contracts demand more of the educator's time (Berger *et al.,*), which could be the reason for its lesser use by food safety extension educators of the NCR, and researchers have found that extension educators do have time constraints (Camara, 2006; Jayaratne, 2001). Koundinya and Duttala (2002) found that teaching through distance education contributed to a statistically significant gain in farmers' knowledge of peanut and mango cultivation practices in India. In the U.S., Dooley *et al.,* (1999) found that distance education methods like videoconferencing were effective in disseminating food safety updates. They reported an increase in the knowledge of Food Protection Management instructors who participated in a food safety instructor training via distance education methods. Shanley *et al.,* (2009) concurred that distance education was indeed an effective method for food safety education.

Another lesser used teaching method was 'case studies' which was being used only rarely to sometimes (M = 1.79) in food safety extension educational programs. This is in-line with the finding of Creswell (1990), who found that case studies were not heavily used by agricultural extension professionals in training private pesticide applicators in Iowa, Nebraska, North Dakota and Wisconsin. Case studies have been identified as one of the more effective teaching methods that promote active learning. A case study approach gives in-depth information (University of Idaho, 2006), can be used to answer how and why questions, and is effective in studying contemporary issues in real-life context (United States Department of Veteran Affairs, 2008; Yin, 2003). Case studies as a teaching method have been found to improve practical thinking, and help learners formulate and solve problems (Marsick, 2004) which are the skills that need to be developed in food safety educational programs.

Objective 3: To identify the extent of use of the selected teaching tools by extension educators

The mean and standard deviation scores computed on the extent of use of the identified teaching tools showed the same trend as that of the teaching methods with none of the tools falling under "Frequently Used" or "Always Used" categories. Brochures (M = 2.32), pamphlets (M = 2.31), newsletters (M = 2.28) and

Table 2: Mean and standard deviation scores of extension educators based on the extent of use of teaching tools in food safety education programs

S. No	Teaching tool	M	SD	*n*
1	Brochures	2.32	1.08	309
2	Pamphlets	2.31	1.10	306
3	Newsletters	2.28	1.19	304
4	PowerPoint®	2.22	1.54	314
5	Internet/websites	2.11	1.17	309
6	Research Publications	1.89	1.19	305
7	Charts	1.82	1.15	308
8	Compact Discs	1.62	1.16	303
9	Videotapes	1.53	1.16	308
10	Posters	1.28	1.26	312
11	Text Books	1.08	1.21	302
12	Podcasts	0.56	0.85	299
13	WebCt	0.54	0.91	306
14	Interactive Whiteboard	0.41	0.82	307

Scale used: 0= Not Used, 1= Rarely Used, 2= Sometimes Used, 3= Frequently Used, 4= Always Used.

PowerPoint® (M = 2.22) were the most commonly used teaching tools, while interactive whiteboard (M = 0.41), WebCt (M = 0.54) and podcasts (M = 0.56) were the least used tools in conducting food safety educational programs (Table 2).

These findings were comparable to related extension education studies. Roberts *et al.,* (2009) reported that adult learners preferred newsletters for receiving information on food safety. Jenkins *et al.,* (2000) concurred with this finding, stating that newsletters are effective in reaching a wide audience. Further, Marrotte (2000) found that learners preferred PowerPoint® presentations. In addition, podcasts have also been found to be useful in extension educational programs (Smith & Davis, 2008; Xie & Gu, 2007); however, the food safety extension educators from this study were not utilizing podcasts that much in their education programs. The same was true for interactive teaching media and other materials found to be useful in food safety educational programs (Bednar *et al.,* 2003; Trepka, 2008). In the same vein, WebCt is being used as a teaching tool in many distance education programs at U.S. land grant institutions, but the extension educators from this study were not using it to a great extent in their food safety educational programs.

In addition to the teaching methods and tools identified in this study, the respondents claimed they "Frequently Used" facilitated dialogue as a teaching method in their food safety programs. In addition to the ones identified for this study, webinars, real-life props and settings, and news columns were commonly used teaching tools. Webinars and news columns were "Frequently Used," whereas real-life props and settings were "Always Used". Thomson, Abel, and Maretzki (2001) indicated facilitated dialogue as a method of educating people on food, farm and community. Similarly, webinars were being used as an educational tool in a livestock insurance website (Small *et al.,* 2008).

CONCLUSIONS AND RECOMMENDATIONS

Four major conclusions were drawn based on the results of the study. First, the typical extension educator who participated in this study was a middle-aged woman with substantial years of work experience and a master's degree. Second, extension educators seemed to use a variety of teaching methods and tools in their food safety educational programs as evidenced by the reports of balanced use of the teaching methods and tools. The extension educators of the NCR were doing a good job of using a combination of different teaching methods and tools in their food safety educational programs and are encouraged to continue doing so.

The third conclusion was that extension educators were not making extensive use of 'distance education', 'case studies', and 'podcasts' in their food safety educational programs, which are commonly used and effective methods and tools in educational programs. The fourth and final conclusion was that extension educators were adopting learner-centered teaching approaches, as evidenced by the maximal use of discussions, demonstrations and lecture-discussion in their food safety educational programs. These three methods require and encourage learner involvement in the educational process. Hence, it is recommended that extension educators continue using these methods. However, given the effectiveness of distance education and case studies, and podcasts, it is also recommended that extension educators utilize these two teaching methods and tool more in their food safety educational programs in addition to the ones they are already using.

Implications

The findings have implications for improving the food safety education delivery to clients in

the North Central Region. This study identified a lesser use of some of the commonly used teaching methods such as distance education and case studies and teaching tools such as podcasts in the food safety extension programs. The reasons for not using these teaching methods and tool to the desired extent need to be researched in future studies and duly addressed. The findings could also have implications for inservice education of extension educators as these educators may not be well trained in using the latest online resources for distance education. There is also a possible lack of resources to carry out online education, and these potential limitations can be found out in future research. Since food safety is a very important topic regardless of the country, the findings from this study have implications for international extension education settings, also. Hence, similar research needs to be conducted in other parts of the world. This study also has implications for designing teaching methods and tools for food safety education programs conducted in formal settings like colleges and universities.

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