

Food Safety Inservice Educational Needs of Agriculture Teachers

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The purpose of this census study was to determine the food safety inservice educational needs of agriculture teachers in Iowa. The population for this study was all of the 211 agriculture teachers in the state out of which 161 were accessible. The response rate was 54.03% of the accessible population and 41.23% of the total population. Eleven food safety topics were identified with input from experts in agricultural education, food science and human nutrition, and animal science, as well as some input from the agriculture teachers themselves. The teachers were asked to rate the extent of their perceived need for inservice education on each topic on a six-point Likert-type scale. The findings indicated that these teachers needed more inservice education on all of these topics. Teachers indicated a greater need for inservice education focusing on foodborne illnesses, food safety, bacterial contamination, food irradiation, food processing, and pesticide pollution. Hence, these topics were identified as the critical professional development areas in food safety. It was recommended that all of the topics be included in the food safety inservice programs for agriculture teachers, with priority given to the identified critical professional development areas.

Keywords: Inservice needs, Professional development, Agriculture teachers, Food safety education

Introduction and Theoretical Framework

According to Buzby (2001), “Food safety has emerged as an important global issue with international trade and public health implications” (p.55). Food safety is a global issue and foodborne illnesses occur in both developing and developed countries (Kafarstein & Abdussalam, 1999), which implies that even the United States is not exempt from food safety problems despite the strict regulatory measures in place. Ellis (2006) stated that food-related illnesses are a serious issue in the United States. Nordstrom, Wilson, Richards, Fivek, Ruffing, and Coe (1999) stated that people are concerned about food safety when they think about animal agriculture, but it is postulated that the case is no different with any other segment of the agriculture industry.

Around 76 million cases of foodborne diseases occur annually in the United States and it is estimated that there are 325,000 hospitalizations and 5,000 deaths annually owing to foodborne diseases (Centers for

Disease Control and Prevention [CDC], 2007). According to the Iowa Department of Inspections and Appeals, in 2007 there were 581 and in 2008 there were 76 food-related cases investigated, respectively. The numbers represent only a fraction of the actual numbers, because only a small percentage of the cases get reported (Iowa Department of Public Health [IDPH], 2008).

Among these cases, young children fall under the high-risk category for foodborne illnesses (IDPH, 2008). Learning safe food practices at an early age is beneficial in the long run, and ensuring that all students receive food safety education is critical (Food and Drug Administration [FDA], 1998). Young people especially should be the target for education in agriculture because people tend to shape their perceptions at an early stage, and changing those perceptions becomes more difficult later in life (Holz-Clause & Jost, 1995).

The Michigan Integrated Food and Farming System (MIFFS) has suggested that increased food system education in the schools is needed

so that people can make more informed choices about the food they eat (Trexler, Johnson, & Heinze, 2000). Many young people do not know the importance of food in maintaining their health. "...Food is seen by youth as entertainment rather than as a source of nutrition" (Trexler et al., 2000, p.34). Families are one of the important sources of information about food, and young people tend to follow what is modeled at home (Trexler et al., 2000). However, this source of information is not always a very knowledgeable one. Therefore, school teachers need to provide food safety education.

The British Nutrition Foundation (2001) stated that for students to receive proper food safety education, teachers must possess sound knowledge and understanding about food and nutrition. This is achievable by correctly identifying their needs and addressing them in professional development programs. Layfield and Dobbins (2002) concurred that a crucial factor in developing successful teachers is correctly identifying their needs. Koundinya and Martin (2008) found that agricultural teachers have a variety of needs and recommended adapting inservice education to these needs.

Inservice education is one of the ways of improving school programs (Christensen, Warnick, Spielmaker, Tarpley, & Straquadine, 2006). Schunk (2008) stated, "There is no substitute for strong professional development among teachers" (p.273). He further stated that teachers must keep up to date on the advances in their fields. These statements stress the importance of inservice education for teachers, and for inservice to be effective, teachers' needs have to be properly identified and addressed through professional development.

Hence, it is essential to identify the agriculture teachers' inservice needs related to food safety education. Even though family and consumer sciences teachers may teach about food safety in their programs, agriculture teachers also teach about food safety from a different perspective because food is a product of agriculture. Little research has been done on identifying these needs. In this context, this study is significant.

The theory of planned behavior (TPB) postulated by Icek Ajzen served as the theoretical framework for this study. According

to the TPB, a person's intentions to perform behaviors can be predicted from attitudes toward the behavior, subjective norms, and perceived behavioral control. Intentions and perceived behavioral control are the major factors influencing a person's actual behavior (Ajzen, 1991). Perceived behavioral control is a person's perception of his/her ability to perform a given behavior (Ajzen, 2006). This could mean that agriculture teachers' perceptions' about a topic like food safety and food safety inservice needs could influence behavioral traits like wanting to have more instructional materials and attending inservice workshops.

The Standards Assessments of the University Teacher Education Program (UTEP) at the Iowa State University served as the conceptual framework for this study (Iowa State University Teacher Education Program, 2005). The following are the eight Standards and Criteria that this university uses: The teacher:

1. demonstrates ability to enhance academic performance and support for implementation of the school district student achievement goals;
2. demonstrates competence in knowledge appropriate to the teaching position;
3. demonstrates competence in planning and preparing for instruction;
4. uses strategies to deliver instruction that meet the multiple learning needs of students;
5. uses a variety of methods to monitor student learning;
6. demonstrates competence in classroom management;
7. engages in professional growth, and
8. fulfills professional responsibilities established by school district.

This study addressed "Standard 2." The findings from this study would indicate the extent to which the teachers meet the standard of being competent in the knowledge about what they teach in their programs.

Purpose and Objectives

The purpose of this study was to determine the food safety inservice educational needs of agriculture teachers in Iowa. The study had the following objectives:

1. To determine the perceptions of agriculture teachers about food safety issues,
2. To determine the extent to which the agriculture teachers were teaching the identified food safety topics in their programs, and
3. To determine the agriculture teachers' perceived inservice needs for the identified food safety topics.

Methods

The Institutional Review Board at the Iowa State University approved this study. An electronic census survey was e-mailed to all agriculture teachers in Iowa using SurveyMonkey®. The population for this study was all 211 agriculture teachers in Iowa out of which 161 served as the accessible population. Fifty teachers were not accessible. Some had changed schools and the move was not updated on the directory, while others had declined to participate in surveys via SurveyMonkey®. The agriculture teacher directory obtained from the Iowa State Department of Education served as the sampling frame. Internal validity concerns inherent in survey research were addressed by using a suitable, reliable and valid measurement tool that could reduce measurement error.

A questionnaire was developed for collecting information from the agriculture teachers. A six-point Likert-type scale was used to collect data pertaining to the three stated objectives that represented sections 1, 2, and 3, respectively, of the questionnaire. There were 8, 11, and 11 items in sections 1, 2, and 3, respectively. Two negative statements (items 5 and 8) were included in section 1 (perceptions about food safety) to identify any response set bias. For measuring the perceptions about food safety (section 1), the scale used was from 1 = Very Strongly Disagree (VSD) to 6 = Very Strongly Agree (VSA). For measuring the extent to which the food safety topics were taught in their programs (section 2), the scale used was from 0 = Not Taught (NT) to 5 = Very Great Extent (VGE). For measuring the perceived inservice need for the food safety topics (section 3), the scale used was from 0 = None (N) to 5 = Very High Need (VHN). The scale started with 0 for sections 2 and 3 because 0 meant absence of the variable being measured.

The questionnaire was validated by an expert panel for face and content validity. The expert panel consisted of professors from the departments of agricultural education, animal science, and food science and human nutrition at the Iowa State University. The questionnaire was pilot-tested with agriculture teachers, and the data were used to establish the reliability of the questionnaire. The agriculture teachers that participated in the pilot test were excluded from the population. For reliability of the questionnaire, Cronbach's α was computed from the data collected in the pilot test. Values of .922, .876, and .925 were reported for sections 1 (perceptions about food safety), 2 (extent taught), and 3 (perceived inservice needs), respectively. George and Mallery (2003) gave the following rule of thumb that is applicable to most situations: $> .9$ – excellent, $> .8$ – good, $> .7$ – acceptable, $> .6$ – questionable, $> .5$ – poor, and $< .5$ – unacceptable. So, the questionnaire used for this study was considered reliable.

The food safety perception statements of section 1 and the food safety topics in sections 2 and 3 were identified by the researchers with help from the expert panel. In addition to input from experts, input to identify the food safety topics under sections 2 and 3 was taken from the agriculture teachers when they attended a food safety workshop conducted by the department of agricultural education at Iowa State University. As part of the workshop credit requirement, the agriculture teachers developed lesson plans for teaching food safety. The topics identified for this study had similarities with these lesson plans. Since the topics were identified adopting a participatory approach, they were considered to be need based.

The agriculture teachers were mailed an email letter informing the purpose of the research. This letter sought their cooperation, and it was made clear that their participation in this study was completely voluntary and they could withdraw at any time they wished. It was also ensured that any changes in the study's objectives would be shared with them. After that the survey was emailed to them and a total of four follow-ups were conducted at suitable time intervals. Their consent for the study was assumed if they filled out the questionnaire.

The study had two limitations. First, 50 teachers out of the total population of 211 were not accessible, so the questionnaire was sent to

only 161 teachers, who served as the accessible population. Second, this study had a response rate of 54.03% of the accessible population and 41.23% of the total population. According to Lindner, 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 of the methods for handling nonresponse error is comparing early to late respondents (Dooley & Lindner, 2003; Miller & Smith, 1983). The two limitations were accounted for by comparing early and late respondents using an independent samples *t*-test. There were no statistically significant differences at the 0.05 level of significance suggesting that the results could be generalized to the non-respondents and inaccessible population. So, these two limitations were reasonably considered as not threats to external validity. For the purpose of this study early respondents were defined operationally as those subjects who responded to the first mailing and the first follow-up, and those who responded after that were treated as late respondents.

Findings

Eighty-seven teachers responded to the survey, resulting in a response rate of 54.03% for the 161 accessible teachers and 41.23% for the total population of 211. An independent samples *t*-test was used to test for any statistically significant differences between early and late respondents. Early and late respondents were compared on the summated mean score for section 1, mean scores for all the food safety topics in sections 2 and 3, age, and teaching experience. There were no statistically significant differences between the two groups at the .05 level of significance. The data were analyzed using SPSS[®] version 17.0, and the findings are presented below.

Demographic Profile of the Agriculture Teachers

The respondents had a mean teaching experience of 18 years, with a standard deviation of 10.60. Their teaching experience ranged from 1–37 years. The mean age of the respondents was 42.41 years with a standard deviation of 11.32. The respondents ranged from 24 to 65 years of age. Since outliers were detected in the age category, a median was calculated to account for the skewed distribution. The median age of the respondents was 46 years, indicating that the age distribution was negatively skewed. A majority (78.6%) of the respondents were male, and had earned a bachelor's degree (73.3%).

Objective 1

Perceptions about food safety were calculated using the mean score of the eight food safety statements. It was defined operationally such that a score of ≤ 3.00 would be considered as a low or negative perception, a score of 3.01–4.50 as moderate, and ≥ 4.51 as high or positive perception about food safety on the six-point Likert-type scale that ranged from 1–6. The respondents had a mean score of 4.32, with a standard deviation of .41, indicating that they had moderate perceptions about food safety.

The frequency distribution, means, and standard deviations of the food safety statements (Table 1) indicated that only three out of the eight food safety statements: “food safety includes many different aspects from farm to table,” “high school agriculture teachers must be educated on food safety issues,” and “pesticide residues affect food safety” had a majority (>50%) of the respondents on either extreme (Very Strongly Disagree + Strongly Disagree and Strongly Agree + Very Strongly Agree) of the scale.

Table 1
Frequency Distribution, Mean, and Standard Deviation scores of Agriculture Teachers Based on their Perceptions About Food Safety

Food safety perception statement	<i>f</i>						<i>M</i>	<i>SD</i>	<i>n</i>
	1	2	3	4	5	6			
Food safety includes many different aspects from farm to table	0	0	0	11	34	41	5.34	.69	86
High school agricultural teachers must be educated on food safety issues	0	0	0	32	35	19	4.84	.75	86
I am willing to pay extra for irradiated food	5	5	37	33	5	0	3.32	.90	85
One can prevent many diseases by consuming irradiated products	3	3	8	53	14	4	3.98	.95	85
The quality of food deteriorates when irradiation is used	1	12	48	16	8	0	4.21	.84	85
Pesticide residues affect food safety	2	2	10	29	24	19	4.48	1.16	86
Irradiated food packets have a special symbol indicating they are irradiated	0	3	22	40	8	9	3.97	.98	82
Irradiation decreases the shelf-life of fruits	9	17	47	10	1	0	4.25	.84	84

1= Very Strongly Disagree, 2= Strongly Disagree, 3= Disagree, 4= Agree, 5= Strongly Agree and 6= Very Strongly Agree

Further, the mean scores (Table 1) of only two statements “food safety includes many different aspects from farm to table” ($M = 5.34$, $SD = .69$) and “high school agriculture teachers must be educated on food safety issues” ($M = 4.84$, $SD = .75$) fell under the VSA and SA categories which were operationally defined as high perception category. This explains for the moderate perceptions of agriculture teachers about food safety.

Objective 2

The frequency distribution (Table 2) for the extent to which agriculture teachers taught the identified food safety topics indicated that a majority of the teachers taught the listed topics from “Not Taught” to “Some Extent” on the scale. It was found that all the topics except food chain had a majority of the teachers in the categories: “Not Taught,” “Low Extent,” and “Some Extent” added together.

Table 2
Frequency Distribution, Mean, and Standard Deviation scores of Agriculture Teachers Based on the Extent to which Selected Food Safety Topics Were Taught

Topic	f						M	SD	n
	0	1	2	3	4	5			
Food irradiation	39	24	20	4	0	0	.87	.92	87
Food chain	4	17	17	35	12	1	2.43	1.13	86
Foodborne illnesses	10	21	33	13	8	2	1.93	1.19	87
Chemical analysis of foods	25	33	17	9	3	0	1.21	1.08	87
Food processing	7	16	33	17	13	1	2.18	1.17	87
Bacterial contamination	11	27	29	14	6	0	1.73	1.09	87
Pesticide pollution	6	16	38	17	9	1	2.11	1.08	87
Safe food preparation	13	22	28	12	10	1	1.85	1.25	86
Food transportation	9	31	24	15	8	0	1.79	1.13	87
Food safety	5	18	25	26	11	2	2.29	1.17	87
Food preparation in retail food service	24	27	24	10	2	0	1.29	1.06	87

0= Not taught, 1= Low Extent, 2= Some Extent, 3= Moderate Extent, 4= Great Extent and 5= Very Great Extent

Also, none of the food safety topics had a high mean score (Table 2), the maximum being 2.43 for the topic food chain, indicating that they were not being taught to a great extent or very great extent by these agriculture teachers.

Objective 3

The frequency distribution (Table 3) of agriculture teachers based on their perceived inservice needs on the identified food safety topics indicated that a great majority of the teachers believed that they had at least some need for inservice education on all the identified food safety topics.

Table 3
Frequency Distribution, Mean, and Standard Deviation scores of Agriculture Teachers Based on the Perceived Inservice Need for Selected Food Safety Topics

Topic	f						M	SD	n
	0	1	2	3	4	5			
Food irradiation	0	5	31	27	19	5	2.86	1.01	87
Food chain	2	10	34	26	11	4	2.52	1.07	87
Foodborne illnesses	0	3	33	24	21	6	2.93	1.02	87
Chemical analysis of foods	1	13	28	31	10	4	2.55	1.06	87
Food processing	0	7	20	33	22	5	2.97	1.02	87
Bacterial contamination	0	5	24	24	24	10	3.11	1.11	87
Pesticide pollution	0	8	22	29	19	7	2.94	1.09	85
Safe food preparation	1	10	20	30	19	7	2.88	1.15	87
Food transportation	1	10	22	35	13	6	2.77	1.09	87
Food safety	0	2	17	26	28	12	2.36	1.03	85
Food preparation in retail food service	2	14	25	28	13	5	2.58	1.16	87

0=No Need, 1=Low Need, 2=Some Need, 3=Moderate Need, 4=High Need and 5=Very High Need

The mean scores (Table 3) for perceived inservice need of all the food safety topics were

in agreement with the frequency distribution that a great majority of the teachers believed that

they had at least some need for inservice education, as all of the food safety topics had a mean perceived inservice need score of more than 2.00. This information indicates that a majority of the agriculture teachers in Iowa perceived that they needed inservice education to adequately teach identified food safety topics.

Conclusions, Discussion, Implications, and Recommendations

Four major conclusions were drawn based on the findings from this study. First, agriculture teachers in Iowa were mainly middle-aged men with substantial years of teaching experience who held a bachelor's degree. Layfield and Dobbins (2002) found that South Carolina agriculture teachers had a mean teaching experience of 14.7 years and that the majority had earned a master's degree. Thobega and Miller (2003) found that a majority of the Iowa agriculture teachers were men with a bachelor's degree. The mean age was 39 years and the mean time of teaching experience was 14 years. The findings from this study echoed the findings of Layfield and Dobbins as well as those of Thobega and Miller as they related to age, gender, and teaching experience, but they differed on educational qualifications, which were only in conformity with Thobega and Miller's study.

Second, these agriculture teachers had moderate perceptions about food safety. Research (Dijksterhuis & Bargh, 2001; Ferguson & Bargh, 2004) shows that perceptions can influence behavior. Also, the Theory of Planned Behavior (TPB) suggests that perceptions can influence behavior. The findings indicated that although overall perceptions toward food safety were at a moderate level, all the agriculture teachers agreed with the statement that they should be educated on food safety issues. From this, it is reasonable to assume that the teachers may be interested in attending inservice workshops. During these workshops, there is a possibility that their perceptions may change to a higher or more positive level, which in turn may lead to a behavioral change of seeking more information about food safety. Hence, it is recommended that more inservice education on food safety be available to agriculture teachers.

Third, at least to some extent the agriculture teachers were teaching food safety in their

programs. Newman and Johnson (1993) found that a majority of agriculture teachers taught a unit on principles of food science. Agriculture teachers identified topics related to food science principles as important in their agriscience programs (Newman & Johnson, 1994). The findings from this study supported the findings from the other two studies that agriculture teachers do teach about food safety in their programs. Further, it was found that a large number of the teachers were not teaching the topic of food irradiation in their programs. More than one quarter of the teachers were not teaching the topics chemical analysis of the food stuffs and food preparation in retail food service. These results indicate that agriculture teachers were teaching about food safety in their programs, but not to a very great extent.

There may be different reasons behind this finding. The agriculture teachers may not be very competent to teach food safety topics and hence were not teaching them in their programs. Newman and Johnson (1994) found that agriculture teachers were not highly competent in teaching topics related to principles of food science. Research should be conducted to determine the competence of agriculture teachers in teaching about food safety, and inservice education should be designed based on the findings. Also, the teachers in family and consumer sciences may already be teaching some of these topics. In that case, the agriculture teachers should collaborate more with these teachers. Future research should determine the extent of current collaboration, and also explore the probable options for future collaboration. Also, curricula may not be up-to-date. In this case, the agriculture teachers should be provided with newer curricula. Newman and Johnson found that a majority (82.8%) of the agriscience teachers needed additional instructional materials for teaching food science. Future research should also determine the agriculture teachers' needs for newer curricula to teach about food safety.

Fourth, a majority of agriculture teachers needed inservice education on food safety. A majority of the teachers had at least some need for inservice education in all the identified topics. Roberts and Dyer (2004) found that 46% and 30% of the traditionally and alternatively certified agriculture teachers, respectively, had a high need for inservice education on topics

related to food science and safety. Agriculture teachers have a strong need for inservice on topics related to the food industry (Newman & Johnson, 1994). The findings from this study were in conformity with the other cited studies, indicating that agriculture teachers are in need of inservice education in order to adequately teach food safety.

It was further found that for the topics foodborne illnesses, food safety, bacterial contamination, food irradiation, food processing, and pesticide pollution, teachers had some to a very high need (Table 3) compared to other areas. Hence, they were identified as critical professional development areas. Therefore, it is recommended that priority should be given to these critical professional development areas during the inservice workshops.

Further, the findings from this study have implications for developing curricula for future food safety workshops. Findings from this study indicated the areas where agriculture teachers need education, and this could be utilized in designing effective future inservice workshops. As mentioned previously, input was also taken from the agriculture teachers in developing the food safety topics in the survey questionnaire, so that the educational material could be adapted for future inservice workshops to make them more meaningful and applicable for classroom use.

The findings and conclusions from this study are important for agriculture teachers to meet the standard of knowledge competency in what they teach, as conceptualized by the Iowa State University Teacher Education Program. The findings from this study suggest that agriculture teachers of this state may not yet be completely meeting this standard, which indicates the need for inservice on food safety topics.

Based on the overall findings from this study, it is also recommended that periodic needs assessment should be conducted on food safety teaching-related inservice needs of the agriculture teachers because food safety education at the secondary school level is very important as suggested by MIFFS (Trexler et al., 2000) and FDA (1998).

As suggested by Buzby (2001), food safety has become a critical concern, and an issue that merits the attention of educators in all kinds of settings. Food safety is a reality and educational programs require attention to all the issues related to food safety. High school agriculture teachers are inclined to teach about food safety in their programs. For this to happen, agriculture teachers need to be competent in teaching about food safety. This standard can be achieved by identifying their needs and addressing them with inservice education.

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