AGRICULTURAL IN-SERVICE NEEDS OF INTRODUCTORY LEVEL CAREER AND TECHNICAL EDUCATION TEACHERS

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Abstract

This study identified and prioritized the agricultural in-service needs of introductory level career and technical education teachers in Utah. The Utah State Board of Education requires that all seventh grade students complete an introductory career and technical education course as their first formal career exploration experience. One component of the course is exploration of the agriculture industry. In order to effectively help students explore agricultural opportunities, teachers, most of whom have little or no formal training in agriculture, must be prepared in their knowledge of the agriculture industry and careers. To meet the needs of teachers, the state office of education has requested relevant, meaningful in-service. A survey based on the Borich needs assessment model was used to determine areas in which teachers need additional support. The "new and emerging technologies in agriculture" standard emerged as an area of weakness. Teachers generally held positive attitudes toward the importance of teaching agriculture, which should be used to promote future in-service programs.

Introduction

The first goal of the National Strategic Plan and Action Agenda for Agricultural Education is, "An abundance of highly motivated, well-educated teachers in all disciplines, pre-kindergarten through adult, providing agriculture, food, fiber and natural resources systems education" (National Council for Agricultural Education, 2000, p. 4). The mission of this same strategic plan is to prepare students "for successful careers and a lifetime of informed choices in the global agriculture, food, fiber and natural resources systems" (p. 3).

"Teachers require an awareness about agriculture if they are to be successful at helping students understand agriculture and its many dimensions" (Knobloch & Martin, 2000, p. 24). The responsibilities to build links in the chains of knowledge that will educate today's students and enable them to become agriculturally literate rests with our educators. This responsibility belongs not only to our agriculture instructors, but teachers at every level from kindergarten through the 12th grade.

Agricultural knowledge that used to be common amongst most Americans has disappeared with each passing generation. "Educational need arises from the inability of the American public to receive agricultural knowledge from everyday experiences as they would have in previous

decades" (Meunier, Talbert, & Latour, 2002, p. 49). In 1988, the National Research Council recommended that "beginning in kindergarten and continuing through twelfth grade, all students should receive some systematic instruction about agriculture" (p. 2). Not only do we need to encourage agricultural literacy in today's students, we also must encourage some of these students to choose agriculture as a career field. Gibbs (2005) stated:

> Traditionally, students have been strongly encouraged at the high school level to consider careers and choose courses that would fortify occupations of interest. Today, administrators and educators across the nation realize that developing students' interest must be addressed earlier-at the middle school level. (p. 28)

In addition to other technical areas, the Utah State Board of Education has attempted to introduce agricultural literacy and agriculture career awareness by implementing the Career and Technical Education, Introduction program (CTE, Introduction). The CTE, Introduction program is a required course for all seventh grade students in the public school system. The program, taught by a team of certified career and technical education teachers, is intended to expose students to a variety of careers. The teacher team that delivers the CTE, Introduction career exploration course includes family and consumer science, business education, and technology education teachers. This team of teachers is required to deliver a minimum of 15 hours of agricultural career exploration instruction. Other career and technical education areas that are explored include health care, marketing, and personal finance. The agriculture standards and objectives have been developed and grouped so that technology education teachers cover the agricultural technology standard, family and consumer sciences teachers cover the food science and nutrition standard, and business teachers cover the agricultural business standard. The CTE, Introduction program and its teachers have the potential to have a significant effect on the career choices of students. If the instructors are unable to accurately represent or portray agriculture and its career possibilities, the agriculture industry may suffer due to a reduced number of qualified applicants for future jobs.

Trexler, Johnson, and Heinze (2000) found that elementary and middle school teachers "perceived that students do not understand where their food comes from and do not care how it arrives at their table" (p. 34). Sadly enough, many of the teachers educating the youth who will someday be our politicians and policy makers are also without basic agricultural knowledge. Contributing to the problem of agricultural illiteracy in today's society is not only ignorance, but apathy as well. In a nation with the safest, most abundant food supply, agriculture is often taken for granted. Additionally, test scores in the core academic subjects have taken priority in our schools (Elliot & Zimmerman, 2002). Introducing agriculture into a curriculum is often viewed as "just one more thing to do."

Balschweid, Thompson, and Cole (1998) found classroom teachers felt the greatest barriers to implementing agriculture in classrooms were time to make the necessary curricular changes and locating agricultural materials and information. Meunier et al. (2002) contend that "these barriers would be greatly lessened if teachers were agriculturally aware, meaning they possessed a better working knowledge of agriculture and agricultural practices" (p. 52).

"Training institutions search continually for ways to improve their training programs" (Borich, 1980, p. 39). In-service and professional development activities are often the primary method used in attempting to improve teacher quality. Borich introduced a model for conducting follow-up studies after in-service or training had been attended. He wrote that the basis of his assessment model was to identify the difference between "what is" and "what should be." Furthermore, Borich stated that a training need can be defined as, "a discrepancy between an educational goal and trainee performance in relation to this goal" (p. 39). He further stated that the model "yields more data, and more understandable data, than many other types of follow-up questionnaires" (p. 42).

The Borich model suggests the following steps: (1) list competencies, (2) survey in-service teachers, (3) rank competencies, (4) compare high priority competencies with training program content, and (5) revise program or revise competency. The competencies with the highest ranking should be considered the highest priority for in-service.

Since the introduction of the Borich (1980) model, many researchers have used it for determining in-service needs of agriculture teachers and extension staff (Barrick & Doerfert, 1989; Barrick, Ladewig, & Hedges, 1983; Edwards & Briers, 1999; Garton & Chung, 1997; Joerger, 2002; Johnson, Schumacher, & Stewart, 1990; Layfield & Dobbins, 2002; McDonald & Lawver, 1997; Newman & Johnson, 1994; Sorenson, Tarpley, & Warnick, 2005; Waters & Haskell, 1989). Barrick et al. studied different approaches to identifying in-service needs of agriculture teachers. The researchers sought to test the effectiveness of the needs assessment model by comparing it with a more direct approach using only one ranking. The conclusion of their study verified the effectiveness of Borich's model in assessing in-service needs of teachers. They stated, "The procedures of using only the importance rankings or the knowledge rankings or the application rankings may not be valid . . . a combination of two or more rankings must be considered to form conclusions regarding in-service education needs" (p. 19). Furthermore, in a study of agriscience teachers in Mississippi, Newman and Johnson found that the rankings of units based solely on importance or competence were reasonably different from those found when using the Borich model, and therefore concluded that the Borich model was a more effective means of assessing in-service needs than a more direct approach.

Purpose and Objectives

The primary purpose of this study was to identify and describe the agricultural in-service needs of Utah Career and Technical Education, Introduction teachers so that valid in-service opportunities can be provided. To achieve this purpose the following objectives served as guidelines:

1. Describe selected personal and professional characteristics of CTE, Introduction instructors.
2. Determine the perceived importance of agricultural literacy competencies related to the goals and objectives set forth by the Utah State Board of Education.
3. Determine the perceived ability levels of CTE, Introduction instructors related to the agricultural literacy competencies based on goals and objectives set forth by the Utah Board of Education.
4. Determine and prioritize in-service needs of CTE, Introduction teachers in relation to the goals and objectives set forth by the Utah Board of Education.

Methods and Procedures

The population for the study consisted of all CTE, Introduction teachers in Utah (N = 515). CTE, Introduction teachers were identified as those who taught at least one class of CTE, Introduction during the 2005-2006 school year. The list of CTE, Introduction teachers was obtained from the Utah Career and Technical Education staff. A census of the population was used. Therefore, generalizations from the results were limited only to the population of the study.

The survey instrument was designed after the Borich (1980) model. Based on the review of literature, the Borich model was found to be the most appropriate means for assessing in-service needs of teachers (Barrick et al., 1983; Borich; Edwards & Briers, 1999; Garton & Chung, 1997; Joerger, 2002; Layfield & Dobbins, 2002; Newman & Johnson, 1994; Waters & Haskell, 1989). The Borich model consists of a list of competencies for potential in-service along with the use of a summated rating scale to rank perceived ability and importance for each competency. Section II consisted of a list of three standards and 20 indicators to be completed by all instructors using a 5-point rating scale in which

teachers were asked to rank the standards based on their perceived ability and importance for each competency and indicator. A 5-point scale was used based on other in-service studies from the review of literature. A post hoc reliability analysis of the instrument was performed to determine if the instrument had an acceptable reliability value. A Cronbach's alpha value of .958 was obtained.

Data were collected by e-mailing the pre-notice letter to all CTE, Introduction teachers. The cover letter with the link to the Internet-based survey was mailed 2 days later. One week later, a reminder e-mail was sent to non-respondents, and another reminder was mailed a week later to the remaining non-respondents. The response rate from the defined population of CTE, Introduction teachers was 261 (50.7%). Follow-up procedures were the first step in controlling for nonresponse error, attempting to get back as many responses as possible (Dillman, 2000). Lindner, Murphy, and Briers (2001) recommended comparing early and late respondents as a method for handling non-response. They recommended that late respondents be operationally defined to include those who respond following the final follow-up stimulus. In this study, 91 (35%) participants responded after the final reminder. The summed responses of the 91 participants considered late respondents were compared to the summed responses of the 170 (65%) participants who responded prior to the final reminder using an independent *t*-test. The analysis indicated no significant difference between the early and late responses, t (259) = -0.725, p = .469 (two-tailed).

Data were analyzed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) version 13.0 for Windows. Descriptive statistics (frequencies, means, and standard deviations) were utilized to analyze the data. Discrepancy scores, weighted discrepancy scores, and mean weighted discrepancy scores (MWDS) were calculated for each core competency. To determine discrepancy scores, weighted discrepancy scores, and MWDS, the following procedures were followed. First, the ability rating was subtracted from the importance rating to determine the discrepancy score for each individual on each competency. Next, the discrepancy score was multiplied by the mean importance rating to calculate the weighted discrepancy score on each individual for each competency. A MWDS for each of the competencies was then calculated by taking the sum of the weighted discrepancy scores and dividing by the number of observations. Using the MWDS, the competencies were then ranked. The competencies with the highest MWDS were those with the highest need and priority for in-service. The competencies were grouped into related categories in which in-service could be provided for the competencies with the highest MWDS.

Findings

Objective 1: Demographic Information

The first research objective was designed to identify the characteristics of the population. Questions included information about the teachers' personal characteristics, program characteristics, and preferred method of in-service delivery. Teachers were asked to report their highest degree earned. The number of teachers who held a bachelor's degree was 169 (64.8%). Ninety-one teachers (34.9%) held a master's degree, and one teacher (0.4%) held a doctorate degree. Forty-nine (18.8%) respondents reported to have been teaching from 1-5 years, counting the present year. Forty-nine (18.8%) teachers reported they had been teaching for 6-10 years. Fifty-five (21.1%) had been teaching for 11-15 years. Fifty-six (21.5%) had been teaching for 16-20 years, and 52 (19.9%) had been teaching for 21 or more years.

Teachers completing the survey were asked to identify which component(s) of the CTE, Introduction curriculum they deliver (Table 1). Of the 261 respondents, 98 (37.5%) delivered the business component, 87 (33.3%) delivered the family and consumer science component, and 103 (39.5%) delivered the technology component. Respondents were also asked to identify the component(s) in which they were certified to teach. Of the 261 teachers, 95 (36.4%) were certified to teach the business component, 80 (30.7%) were

certified to teach the family and consumer science component, 97 (37.2%) were certified to teach the technology component, 21 (8.0%) were certified to teach agriculture, and 21 (8.0%) were certified to teach another component, which may have included health technology or marketing.

Table 1
Career and Technical Education Areas in which CTE, Introduction Teachers Were Certified

Description	*n*	%
Business education	95	36.4
Family and consumer science education	80	30.7
Technology education	97	37.2
Agricultural education	21	8.0
Other (health, marketing, etc.)	21	8.0

Note. Teachers may be certified in more than one area.

Forty-six (17.6%) teachers reported being students in an agriculture class in high school, while 215 (82.4%) reported that they never took an agriculture class in high school. There were 35 (13.4%) respondents who reported being FFA members at one time in high school, while 226 (86.6%) were not.

Teachers were asked to rank which method of in-service was most preferred on a scale of 1 to 5. The most preferred method of in-service was a traditional workshop held at the local or regional level. The least preferred in-service delivery was independent study or online delivery.

Respondents were asked to indicate on a scale of 1 to 5 (1 = *not important*, 5 = *very important*) how important it was to receive credit for participating in professional development. Nearly two-thirds (65.9%) indicated that receiving credit for participating in professional development was very important. Forty-one teachers (15.7%) responded that receiving credit was important. Thirty teachers (11.5%) selected the neutral response. Eight teachers (3.1%) responded that receiving credit was somewhat important, and 10 teachers (3.8%) indicated that receiving credit was not important.

Teachers were asked whether or not they had participated in an agricultural in-service or workshop in the past two years. As summarized in Table 2, 96 teachers (36.8%) had participated in an agricultural in-service or workshop, while 165 (63.2%) had not.

Table 2
Teachers Participating in Agricultural In-Service or Workshops in the Past 2 Years

Description	*f*	%
Teachers who did participate in agricultural in-service or workshops in the past 2 years.	96	36.8
Teachers who did not participate in agricultural in-service or workshops in the past 2 years.	165	63.2

Teachers were asked to give their opinion on the importance of students learning about agricultural careers in CTE, Introduction (1 = *not important*, 5 = *very important)*. Responses for this question are summarized in Table 3. Two (0.8%) responded that it is not important for students to learn about agricultural careers in CTE, Introduction. Fourteen (5.4%) responded that it was somewhat important, and 61 (23.4%) selected the neutral response. Ninety-two (35.2%) teachers indicated they thought it was important to teach agricultural careers in CTE, Introduction, and 92 (35.2%) indicated they thought it was very important.

Table 3
CTE, Introduction Teachers' Opinion of Importance of Students Learning About Agriculture and Agricultural Careers in CTE, Introduction

Ranking	*f*	%
Very important	92	35.2
Important	92	35.2
Neutral	61	23.4
Somewhat important	14	5.4
Not important	2	0.8

Objectives 2 and 3: Perceived Importance and Perceived Ability of CTE, Introduction Competencies

The goal of the second and third research objectives was to determine the teachers' perceived level of importance and ability for each core competency. Objectives two and three were necessary steps in determining the MWDS and rank of each competency for the purpose of prioritizing in-service needs. Section II of the survey instrument contained 20 core competencies in which teachers ranked their perceived importance and ability to teach each competency related to three core standards.

For the standard "Recognize and explain how the agricultural system works (production to consumption)," the competency "Exploring career opportunities in agricultural production" received the highest mean ability score (3.56) while "Exploring agricultural career opportunities in science and engineering" received the highest mean importance score (3.98) (Table 4).

Table 4
Mean Ability and Mean Importance of Core Competency In-Service Needs of CTE, Introduction Teachers for the Standard "Recognize and explain how the agricultural system works (production to consumption)"

In-service need	Ability Mean (*SD*)	Importance Mean (*SD*)
Explore career opportunities in agricultural production.	3.56 (1.00)	3.92 (0.91)
Explore career opportunities in agricultural education	3.27 (1.05)	3.70 (0.94)
Identify career educational requirements and salary ranges for the above listed careers.	3.13 (1.27)	3.88 (0.92)
Explore agricultural career opportunities in science and engineering.	3.06 (1.18)	3.98 (0.87)
Explore career opportunities in agricultural management and business.	3.06 (1.13)	3.74 (0.97)
Explore career opportunities in agricultural communications	2.90 (1.07)	3.47 (0.95)
Explore career opportunities in forestry production	2.86 (1.11)	3.47 (0.96)
Explore career opportunities in government services as related to agriculture.	2.75 (1.10)	3.52 (0.98)

Note. n = 261. Ability: 1 = very low, 2 = low, 3 = average, 4 = high, 5 = very high. Importance: 1 = very unimportant, 2 = unimportant, 3 = average importance, 4 = important, 5 = very important.

For the standard "Explore and identify emerging agricultural technologies and related careers," the competency "Explore and identify careers in nutrition and new technologies for food safety" received the highest mean ability score (3.31) and the highest mean importance score (4.10) (Table 5).

Table 5
Mean Ability and Mean Importance of Core Competency In-Service Needs of CTE, Introduction Teachers for the Standard "Explore and identify emerging agricultural technologies and related careers"

In-service need	Ability Mean (*SD*)	Importance Mean (*SD*)
Explore and identify careers in nutrition and new technologies for food safety	3.31 (1.21)	4.10 (0.92)
Explore and identify careers in bio-energy (fuels, and other manufacturing processes)	2.62 (1.17)	3.92 (0.92)
Explore and identify careers in GIS/GPS applications such as precision agriculture and livestock	2.60 (1.24)	3.60 (1.03)
Explore and identify careers in environmental monitoring	2.58 (1.14)	3.74 (0.93)
Explore and identify careers in biotechnology and cloning	2.67 (1.12)	3.69 (0.97)

Note. n = 261. Ability: 1 = very low, 2 = low, 3 = average, 4 = high, 5 = very high. Importance: 1 = very unimportant, 2 = unimportant, 3 = average importance, 4 = important, 5 = very important.

Similarly, the competency "Comparing facts and opinions concerning nutrition" received the highest mean ability score and "Comparing facts concerning food contamination and food safety" received the highest mean importance score (Table 6).

Objective 4: Determine and Prioritize In-Service Needs

The purpose of objective four was to calculate a MWDS for each core competency and rank each competency in order of in-service priority. The mean ability and mean importance for each of the 19 core competencies is summarized in Table 7. The top three in-service needs for CTE, Introduction teachers were as follows: (a) explore and identify careers in bio-energy (MWDS = 5.09), (b) explore and identify careers in environmental monitoring (MWDS = 4.31), and (c) explore and identify careers in biotechnology and cloning (MWDS = 3.75). The content standards receiving the lowest ranking included: (a) recognize and explain how the agricultural system works (MWDS = 1.41), (b) explore career opportunities in agricultural education (MWDS = 1.59), and (c) compare facts and opinions concerning agricultural economics (MWDS = 1.91).

Table 6
Mean Ability and Mean Importance of Utah Core Competency In-Service Needs of CTE, Introduction Teachers for the Standard "Compare facts and opinions concerning agriculture"

In-service need	Ability Mean (*SD*)	Importance Mean (*SD*)
Compare facts and opinions concerning nutrition	3.54 (1.17)	4.08 (0.97)
Compare facts and opinions concerning food contaminants and food safety	3.46 (1.13)	4.17 (0.93)
Compare facts and opinions concerning agricultural economics	3.41 (1.12)	3.90 (0.93)
Compare facts and opinions concerning the environment	3.13 (1.05)	3.97 (0.93)
Compare facts and opinions concerning trade	3.05 (1.06)	3.72 (0.93)
Compare facts and opinions concerning science in agriculture	3.04 (1.16)	3.80 (0.95)
Compare facts and opinions concerning agricultural processes	2.90 (1.15)	3.51 (0.96)

Note. $n = 261$. Ability: 1 = very low, 2 = low, 3 = average, 4 = high, 5 = very high. Importance: 1 = very unimportant, 2 = unimportant, 3 = average importance, 4 = important, 5 = very important.

Table 7
Summary of In-Service Needs for CTE, Introduction Teachers Based on Standards and Objectives Set Forth by the Utah Board of Education (n = 261)

Objective	Rank	MWDS[a]
Explore and identify careers in bio-energy	1	5.09
Explore and identify careers in environmental monitoring	2	4.31
Explore and identify careers in biotechnology and cloning	3	3.75
Explore agricultural career opportunities in science and engineering	4	3.68
Explore and identify careers in GIS/GPS applications such as precision agriculture and livestock identification	5	3.59
Compare facts and opinions concerning the environment	6	3.35
Explore and identify careers in nutrition and new technologies for food safety and security	7	3.25
Identify career educational requirements and salary ranges for agricultural careers	9	2.90
Compare facts and opinions concerning science in agriculture	10	2.90
Explore career opportunities in government services as related to agriculture	11	2.68
Explore career opportunities in agricultural management and business	12	2.54
Compare facts and opinions concerning trade	13	2.47
Compare facts and opinions concerning nutrition	14	2.24
Compare facts and opinions concerning agricultural processes	15	2.14
Explore career opportunities in forestry production	16	2.11
Explore career opportunities in agricultural communications	17	1.97
Compare facts and opinions concerning agricultural economics	18	1.91
Explore career opportunities in agricultural education	19	1.59
Recognize and explain how the agricultural system works	20	1.14

[a]MWDS = mean weighted discrepancy score.

Conclusions/Recommendations/ Implications

The majority of CTE, Introduction teachers responding to the survey (n = 184 or 70.4%) indicated that, in their opinion, teaching students about agriculture and agriculture careers in CTE, Introduction is important or very important. This generally positive perception toward the agriculture industry should be utilized in providing professional development opportunities to CTE, Introduction teachers.

Using the Borich needs assessment model (Borich, 1980) for core competencies, responses determined the following five objectives as the most needed for in-service overall: explore and identify careers in bio-energy, explore and identify careers in environmental monitoring, explore and identify careers in biotechnology and cloning, explore agricultural career opportunities in science and engineering, and explore and identify careers in GIS/GPS applications such as precision agriculture and livestock identification. Of these objectives, four out of the five came from the same standard: explore and identify emerging agricultural technologies and related careers.

Competencies with lesser need for in-service, with an MWDS of lower than 2.0 were: explore career opportunities in agricultural communications, compare facts and opinions concerning agricultural economics, explore career opportunities in agricultural education, and recognize and explain how the agricultural system works. The low score for the ~~"r~~ecognize and explain how the agricultural system works" objective has major implications for agricultural literacy programs such as Agriculture in the Classroom. Do middle-level teachers expect students to already have a knowledge of the agricultural system prior to taking this course? Or, do teachers simply view this as an area that is not important? Either way, agricultural literacy programs have a large role to play in helping elementary-level students develop an understanding of the agricultural system.

Based upon the findings of this research, it is suggested that in-service be provided in the areas of emerging agricultural technologies and related careers. It is also recommended that that all CTE teacher education programs be involved in providing in-service training that incorporates agricultural literacy into each CTE area. Further, in-service should be provided to CTE, Introduction teachers in the form of local/regional onsite workshops, with the option of continuing education units or university credit with a pass/fail option, and teachers should be encouraged to form partnerships with local agriculture business and industry professionals to promote agricultural literacy and career awareness. It is also suggested that curriculum materials be developed for CTE, Introduction teachers on bio-energy, environmental monitoring, and biotechnology. CTE, Introduction training and in-service at summer CTE conferences, mid-winter CTE conferences, and summer institutes should use these recommendations to plan future professional development programs.

Additional research is recommended to determine if middle-level students already posses knowledge of how the agricultural system operates, from production through consumption prior to taking the CTE, Introduction course.

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