PRE-SERVICE TEACHERS' KNOWLEDGE AND TEACHING COMFORT LEVELS FOR AGRICULTURAL SCIENCE AND TECHNOLOGY OBJECTIVES

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Abstract

Self-efficacy beliefs are defined as context-specific assessments of one's competence to perform specific tasks, influence one's efforts, persistence, and resilience to succeed in a given task. Such beliefs are important determinants when considering agricultural science teachers' subject matter knowledge, teaching comfort levels, and their likelihood for success in the classroom. The purpose of this study was to assess selected Texas pre-service agricultural science teachers' knowledge and comfort for teaching state-mandated general agricultural science and technology objectives. Selected pre-service agricultural science teachers representing four Texas teacher education programs responded. Respondents' summed knowledge and teaching comfort scores revealed perceptions of "adequacy" in seven of the eight general agricultural science and technology areas. However, they had low levels of knowledge and teaching comfort for the soils and soil formation objectives. A moderate positive association existed between overall knowledge and teaching comfort, supporting previous self-efficacy research. The findings indicated that pre-service teachers need additional preparation in the eight areas essential to every agricultural education classroom. Additional research in pre-service teacher self-efficacy, confidence, and competence is needed to identify causal factors affecting the less-than-desired levels of knowledge and teaching comfort for state-mandated general agricultural science and technology objectives.

Introduction

Much research has focused on studying pre-service agricultural science teachers. Shelly-Tolbert, Conroy, and Dailey (2000) concluded that students in agricultural education (AGED) programs are more diverse today, with many students having little or no traditional agricultural backgrounds. Extrapolation from work by Abbott (2003) supports the idea that students entering the AGED teaching profession may have been influenced to do so by their parents' occupations.

Other researchers concentrated on formative influences exerted on student teachers by their cooperating teachers and centers (Deeds, Flowers, & Arrington, 1991; Harlin, Edwards, & Briers, 2002). Some investigators (Dormody & Torres, 2002) cited influences from classroom performance of teachers' assessments of their own knowledge bases. Reardon (2005, n. p.) stated

> Highly qualified teachers are defined in the No Child Left Behind Act of 2001 (NCLB) as those who not only possess state certification, but who also have

> content knowledge of the subjects they teach. In Career and Technical Education (CTE), teachers need to be competent in technical, employability, and academic skills. Additionally, high-quality CTWE [Career Technical/Workforce Education] teachers are essential in helping the United States develop a 21st-century workforce that will be competitive in the world marketplace.

Are new agricultural science teachers knowledgeable and comfortable with teaching agriculture curricula, according to an established set of state standards (i.e., competencies)? This study attempted to answer this question by measuring the impact of self-efficacy on one's perceived performance and correlated such impact with influences exerted by explicit course-content guidelines.

Conceptual Framework

Bandura (1986) associated students' perceptions of their competence in a subject to their motivation and achievement in that subject, a perception he termed "self-efficacy." Self-efficacy has been defined by Pajares and Miller (1994) as "a context-specific assessment of competence to perform a specific task, a judgment of one's capabilities to execute specific behaviors in specific situations" (p. 194). Pajares (1996) found that "self-efficacy beliefs are strong determinants and predictors of the level of accomplishment that individuals finally attain" (p. 545) and that self-efficacy is linked to level of effort, persistence, and resilience in an endeavor.

Fritz and Miller (2003) found student teachers "were more focused on dealing with self-adequacy concerns" (p. 51) involving subject matter and discipline issues than on other areas. They proposed "addressing concerns during student teaching to help teachers when they enter their first year of teaching" (p. 52).

An earlier study by Cano and Newcomb (1990) specifically compared agricultural science teachers' teaching plans to Ohio state guidelines and assessed those teaching plans according to a theoretical framework of cognition levels. Cano and Newcomb determined that "teachers are devoting a greater percentage of time to some subject matter areas than is recommended by state of Ohio guidelines and spending less time in other areas" (p. 51), however they did not attempt to correlate such adherence or deviation with measures of self-efficacy.

McLean and Camp (2000) examined selected pre-service agricultural teacher education programs and concluded that the "content depth of teacher preparation programs in [agricultural education] varied widely across the institutions" (p. 33). The authors stated that members of the agricultural education profession "should be able to agree on certain, fundamental knowledge and skills needed by potential teachers in agricultural education" (p. 33), but noted that little agreement existed between institutions as to what was needed to prepare future agricultural education teachers. McLean and Camp further indicated that agricultural education professionals needed to agree (i.e., seek a consensus) on the basic skills that should be taught to pre-service agricultural science teachers. Conroy and Kelsey (2000) found that teacher educators felt "standards could be utilized as the basis for reforming pre-service curriculum, which would result in enhanced program planning and a structure for staff development at the university level" (p. 13), thereby providing support for the McLean and Camp study.

Joerger's (2002) findings supported earlier studies, in that he found a need for "researchers to aggregate, validate, test and refine a contemporary list of professional competencies that could be used as a basis for assessing the competence and inservice education needs of beginning agricultural education teachers" (p. 22).

Such research indicates a strong need for using standardized competencies when evaluating agricultural science teachers' subject matter knowledge and comfort levels for teaching specific subjects in the classroom. By adhering to standardized competencies, individual states could uniformly implement the types of instruction needed in pre-service agriculture programs, thereby better preparing future agriculture teachers.

Texas' efforts to provide such competencies are exemplified by the Texas Essential Knowledge and Skills (TEKS). TEKS, a state-mandated curriculum with specific objectives, were created by the Texas State Board of Education (Texas Education Agency, 1998), working

> with the direct participation of educators, parents, business and industry representatives, and employers…[T]eams composed of representatives of each of these groups drafted curricula for each content area and grade level, kindergarten through Grade 12, such that the knowledge and skills would: ensure rigor in the curriculum; articulate what all students should know and be able to do; specify the levels of performance expected of students at particular grade levels; and ensure that the knowledge and skills meet the learning needs of all students. (p. 47)

TEKS objectives direct the teaching of all curricula in Texas. According to the Texas Education Agency, school districts and schools where students do not master class-specific TEKS objectives may suffer state sanctions (Texas Education Agency, 2005b). Teachers must align their instruction to the TEKS objectives, with particular attention to subject matter and grade level. TEKS objectives provide uniform guidelines for mastery of knowledge and skills expected in all classes (K-12). Therefore, it is imperative that pre-service teachers of all subjects are knowledgeable of and comfortable with teaching subject matter according to the TEKS objectives, including agricultural science teachers.

Purpose and Objectives

The purpose of this study was to assess selected Texas pre-service agricultural science teachers' knowledge and comfort levels for teaching the applied agricultural science and technology TEKS (i.e., eight comprehensive high school knowledge and skill areas). The specific objectives were to

1. Measure pre-service teachers' self-perceived knowledge levels of the comprehensive high school TEKS.
2. Measure pre-service teachers' self-perceived comfort levels for teaching the comprehensive high school TEKS.
3. Determine if associations existed between pre-service teachers' knowledge and comfort levels for each of eight comprehensive high school knowledge and skill area objectives.

Methodology

A descriptive-correlational design (Field, 2000) was used to determine pre-service agricultural science teachers' knowledge and comfort levels for each of eight applied agricultural science and technology area objectives, as specified by the TEKS-Comprehensive, High School Subchapter B §119.13 (Texas Education Agency, 2005a). The target population included four Texas universities (Texas A&M, Texas Tech, Tarleton State, and Sam Houston State) with agricultural science teacher preparation programs. The accessible population included all pre-service agricultural science teachers enrolled in and completing their student teaching internships by December 2005. A census was conducted of the 63 participants.

State-mandated essential knowledge and skills in the comprehensive program for the introduction to applied agricultural science and technology contain 30 objectives in eight applied areas (Texas Education Agency, 2005a) (Table 1).

Table 1
Applied Agricultural Science and Technology Knowledge and Skill Areas

Areas	n^a	Example Objectives—The student is expected to:
Employability Characteristics	5	Identify employers' expectations, appropriate work habits, and good citizenship skills. Plan and conduct supervised agricultural experience programs.
Mechanical Skills	5	Demonstrate safety and appropriate laboratory procedures. Perform basic agricultural construction skills.
Agriculture and the Environment	4	Determine the effects of chemicals upon the environment. Identify fuel and water conservation methods.
Animal Science	4	Identify breeds and classes of livestock. Explain animal growth and development.
Plant and Soil Science	4	Identify plants of importance to agriculture. Discuss plant germination, growth, and development.
Business Management	3	Identify opportunities for entrepreneurship. Maintain a record-keeping system.
Soil and Soil Formation	3	Identify the components and properties of soils. Classify soil formations.
Food Science	2	Identify the importance of food science technology. Determine trends in world food production.

[a]Total number of objectives per skill area

Use of TEKS objectives established content validity because Texas requires these objectives be taught in grades 9-12. The Comprehensive, High School Subchapter B §119.13 was selected for this study because (a) it cites specific hands-on skills that students should be able to perform and (b) the skills are applicable to all other courses in applied agricultural science and technology (Texas Education Agency, 2005a).

Dillman's Tailored Design Method (2000) was modified for use in this study. An online portal, consisting of an information and consent page and the survey questionnaire, was created to complete the research. The online method was chosen for questionnaire delivery based on its ability to achieve fast response rates for minimal expense (Ladner, Wingenbach, & Raven, 2002), and for its suitability with college students (Kypri, Gallagher, & Cashell-Smith, 2004). The information and consent page provided an explanation of the study's purpose, detailed Institutional Review Board (IRB) approval, and contact information.

The data collection instrument contained two sections. The first section was developed using the Borich model for needs assessment (Borich, 1980); students were asked to indicate their knowledge levels (none = 0, low = 1, adequate = 2, high = 3) and their comfort levels (none = 0, low = 1, adequate = 2, high = 3) for each of the 30 comprehensive applied agricultural science and technology objectives.

Scores for the TEKS objectives were summed to evaluate selected pre-service agricultural science teachers' knowledge and teaching comfort levels in each skill area and their overall knowledge and comfort levels. Summed scale reliabilities, using Cronbach's alpha coefficient (Cronbach, 1951), were computed for the eight subscales in applied agricultural science and technology skill areas (Table 2). Overall, the knowledge (.83) and comfort level (.88) scales provided reliable data for analyses and interpretation. Seven of the eight subscales were determined to be reliable with alpha coefficients ranging from .79 to .95. The employability characteristics knowledge subscale had an alpha of .50. Despite Tuckman's (1999) statement that "Observational reliabilities should be at .75 or above…and .50 or above for attitude tests" (p. 445), the researchers excluded the employability characteristics scales from bivariate analyses.

Table 2
Reliability Coefficients for Applied Agricultural Science and Technology Skill Area Scales

		Reliabilities	
Knowledge and Skill Areas	Objectives	Knowledge Scale	Comfort Scale
Agricultural Mechanics	5	.86	.89
Employability Characteristics	5	.50	.70
Agriculture and the Environment	4	.87	.90
Animal Science	4	.83	.88
Plant and Soil Science	4	.79	.87
Agricultural Business Management	3	.81	.81
Soils and Soil Formation	3	.94	.95
Food Science	2	.80	.80
Summed Scales	30	.83	.88

The second section of the instrument collected descriptive data from the population. Respondents indicated the number of college courses completed in eight applied agricultural science and technology areas. Pre-service teachers were asked to complete demographic characteristics, including gender, age, ethnicity, graduate/undergraduate classification, agricultural background, plans after graduation, location of high school from which they graduated, and whether their parents were teachers.

University-supplied electronic mail (e-mail) addresses were used to contact the respondents. A survey pre-notice was sent via e-mail to the population three days prior to the actual questionnaire. At that time, six e-mail addresses were found to be invalid. The researchers contacted university personnel and searched university sites to obtain valid e-mail addresses. The pre-notice was re-sent to these six pre-service teachers, confirming e-mail addresses as valid.

An e-mail containing the survey notice was sent three days later. A compressed time schedule was used for successive follow-up notices based on findings of Fraze, Hardin, Brashears, Haygood and Smith (2003) that Web surveys yield responses sooner than do postal mail surveys, so reminders can be more closely spaced. The study notice was generated as an e-mail merge so each respondent received a personalized notice with a unique password and a hyperlink to the questionnaire. The notice explained the study's purpose, IRB approval, a questionnaire hyperlink, each respondent's unique password, and contact information.

Respondents were offered a lottery incentive (one chance at one of four $50 gift certificates; one per school represented). Those who completed the questionnaire and who consented (voluntarily provided a valid e-mail address) to the incentive were entered into the lottery drawing. Dillman (2000) questioned the value of an economic exchange incentive "in which money serves as a precise measure of the worth of one's actions" (p. 14), but Singer (2000) and Porter and Whitcomb (2003) found lottery-type incentives increased response rates.

Three follow-up e-mail notices were sent to non-respondents at three-day intervals after the initial study notice. The second follow-up notice reminded non-respondents to complete and submit the questionnaire, as well as offered them the option of completing a paper version, or to not receive additional notices about their participation in the research. The original survey notice and three follow-up reminders produced a response rate of 63% (N = 39), which is comparable to Dillman's (2000) expectations of e-mail survey response rates. Findings should be generalized only to the respondent group (N = 39).

Descriptive statistics were calculated to describe the respondents. Bivariate analyses were used to describe relationships between pre-service agricultural science teachers' perceived knowledge and comfort levels for the applied agricultural science and technology objectives. Relationships between variables with continuous scores were analyzed using Pearson's product-moment correlations (Borg & Gall, 1989) and measures of association were described using the standards established by Davis (1971).

Results

Selected pre-service agricultural science teachers (N = 39) representing four Texas teacher education programs participated in the research. The majority (71.8%) of respondents were from Texas A&M University (n = 18) and Tarleton State University (n = 10). Respondents were female (n = 22), Caucasian (n = 38), 25 or younger (n = 35), and undergraduates (n = 32). Most (92.3%) had graduated from a Texas high school, and 46% (n = 18) had farm/ranch backgrounds. Ten respondents indicated that at least one parent was a teacher, and 56% planned to teach agriculture upon completion of their program (Table 3).

Table 3
Characteristics of selected Texas Pre-Service Agricultural Science Teachers (N = 39)

Category	Subcategory	*f* [a]	%
University	Texas A&M University	18	46.2
	Tarleton State University	10	25.6
	Texas Tech University	7	17.9
	Sam Houston State University	4	10.3
Gender	Female	22	56.4
	Male	17	43.6
What is your agricultural background?	Working farm/ranch	18	46.2
	Urban, some ag. experience	10	25.6
	Rural, but non-farm/ranch	7	17.9
	Urban, no ag. experience	4	10.3
What are your immediate plans after	Teach agriculture	22	56.4
	Attend graduate school	7	17.9
	Other	7	17.9
	Teach a non-agriculture area	3	7.7

[a]Frequencies may not total 39 because of missing data

Research objectives 1 and 2 were answered by descriptive analyses. Respondents' viewed themselves as highly knowledgeable (*M* = 2.70) and comfortable (*M* = 2.62) with teaching employers' expectations, appropriate work habits, and good citizenship skills. Pre-service teachers felt they had high knowledge (*M* = 2.51), but only adequate comfort (*M* = 2.43) levels in demonstrating knowledge of personal and occupational safety practices in the workplace. They had low levels (*M* = 0.51–1.50) of knowledge and teaching comfort for the TEKS objectives in soils and soil formation. Pre-service teachers indicated adequate knowledge and teaching comfort levels for all other TEKS objectives (Table 4).

Table 4
Mean Knowledge and Teaching Comfort Levels by TEKS Objective (N = 39)

	Knowledge		Comfort	
Knowledge and Skill Areas with TEKS Objectives	*M*[a]	*SD*	*M*[a]	*SD*
Agricultural Mechanics:				
Identify major areas of mechanized agriculture.	1.89	.80	1.84	.72
Demonstrate safety and appropriate laboratory procedures.	2.53	.60	2.32	.66
Perform basic agricultural construction skills.	2.18	.77	1.97	.79
Identify lumber and computes a bill of materials.	2.08	.91	2.00	.84
Identify and use fasteners.	1.97	.91	1.89	.86
Employability Characteristics:				
Identify career development and entrepreneurship opportunities in the field of agriculture/agribusiness.	2.16	.55	2.16	.65
Apply competencies related to resources, information, interpersonal skills, and systems of operation in agriculture/agribusiness.	2.03	.60	2.03	.76
Demonstrate knowledge of personal and occupational safety practices in the workplace.	2.51	.56	2.43	.60
Identify employers' expectations, appropriate work habits, and good citizenship skills.	2.70	.46	2.62	.55
Plan and conduct supervised agricultural experience programs.	2.05	.74	2.08	.76
Agriculture and the Environment:				
Determine the effects of chemicals upon the environment.	1.79	.58	1.73	.77
Identify requirements for the proper use of agricultural chemicals.	1.66	.78	1.63	.75
List alternative energy sources.	1.89	.84	1.74	.79
Identify fuel and water conservation methods.	1.97	.75	1.84	.79
Animal Science:				
Explain animal growth and development.	2.29	.52	2.32	.53
Describe animal anatomy and physiology.	2.18	.65	2.24	.71
Identify breeds and classes of livestock.	2.55	.65	2.53	.69
Discuss animal selection, reproduction, breeding, and genetics.	2.32	.77	2.37	.75
Plant and Soil Science:				
Describe the structure and functions of plant parts.	2.24	.64	2.14	.71
Discuss plant germination, growth, and development.	2.08	.72	2.03	.76
Know plant reproduction, genetics, and breeding.	2.03	.65	1.84	.69
Identify plants of importance to agriculture.	2.41	.60	2.28	.74
Agricultural Business Management:				
Prepare a personal budget.	2.29	.80	2.29	.73
Maintain a record-keeping system.	2.29	.65	2.24	.71
Identify opportunities for entrepreneurship.	2.30	.70	2.29	.65
Soils and Soil Formations:				
Identify the components and properties of soils.	1.47	.84	1.36	.87
Describe the process of soil formation.	1.33	.72	1.28	.74
Classify soil formations.	1.41	.76	1.33	.79
Food Science:				
Identify the importance of food science technology.	1.87	.78	1.92	.82
Determine trends in world food production.	1.73	.77	1.84	.72

Note. [a]None = 0 – 0.50; Low = 0.51 – 1.50; Adequate = 1.51 – 2.50; High = 2.51 – 3.00.

To complete the third objective, pre-service agricultural science teachers' knowledge and teaching comfort levels were summed, revealing perceptions of "adequacy" in seven of the eight applied agricultural science and technology skill areas (Table 5). Respondents perceived themselves as having "adequate knowledge" (*M* = 55.79, *SD* = 12.52) and "adequate comfort" (*M* = 54.54, *SD* = 13.10) for 27 objectives in seven applied agricultural science and technology areas. The eighth area, soils and soil formation, resulted in low levels for knowledge (*M* = 3.92, *SD* = 2.36) and teaching comfort (*M* = 3.67, *SD* = 2.42).

Table 5
Pre-Service Teachers' Knowledge and Teaching Comfort Levels by TEKS Skill Areas (N = 39)

	Knowledge		Comfort	
TEKS Areas	*M*	Perception	*M*	Perception
Agricultural Mechanics[a]	10.38	Adequate	9.77	Adequate
Employability Characteristics[a]	10.87	Adequate	10.74	Adequate
Agriculture and the Environment[b]	7.08	Adequate	6.72	Adequate
Animal Science[b]	9.10	Adequate	9.21	Adequate
Plant and Soil Science[b]	8.26	Adequate	7.79	Adequate
Agricultural Business Management[c]	6.64	Adequate	6.64	Adequate
Soils and Soil Formation[c]	3.92	Low	3.67	Low
Food Science[d]	3.46	Adequate	3.67	Adequate
Summed Scales	59.72	Adequate	58.21	Adequate

[a]None = 0 – 2.5; Low = 2.51 – 7.50; Adequate = 7.51 – 12.5; High = 12.51 – 15.0.
[b]None = 0 – 2.0; Low = 2.1 – 6.0; Adequate = 6.1 – 10.0; High = 10.1 – 12.0
[c]None = 0 – 1.5; Low = 1.51 – 4.50; Adequate = 4.51 – 7.5; High = 7.51 – 9.0
[d]None = 0 – 1.0; Low = 1.1 – 3.0; Adequate = 3.1 – 5.0; High = 5.1 – 6.0

Pearson's correlation analyses were used to determine if relationships existed between pre-service teachers' overall knowledge and teaching comfort levels for seven (Employability Characteristics was excluded from correlation analyses because of low subscale reliabilities) of the TEKS applied agricultural science and technology areas. A moderate (Davis, 1971) positive association (*r* = .37) existed between overall knowledge and teaching comfort levels. As respondents' knowledge of the TEKS applied agricultural science and technology areas increased, so too did their comfort levels for teaching those objectives.

Correlational analyses revealed substantial (r = .50 – .69) associations between knowledge and teaching comfort levels for six of the seven applied agricultural science and technology skill areas (Table 6). The soils and soil formation area resulted in a very strong (r = .70 – 1.00) association for respondents' perceived low levels of knowledge and teaching comfort in this skill area. Analyses also indicated moderate (r = .30 – .49) relationships between similar knowledge and skill areas, such as between soils and plant science; animal science and food science; and agricultural mechanics and the environment.

Table 6
Pearson r Correlations for Knowledge and Teaching Comfort Levels

	Knowledge Levels						
Comfort Levels	1	2	3	4	5	6	7
1. Soils/Soil Form.	.87	.37	-.20	-.11	-.15	-.06	-.20
2. Plant & Soil Science	.33	.53	-.01	-.23	-.21	-.05	.22
3. Animal Science	-.18	-.10	.50	.17	-.01	.13	.25
4. Food Science	.09	.05	.38	.67	.06	.38	.44
5. Ag. Mechanics	-.12	-.08	.16	-.11	.65	.37	.21
6. Ag. and Environment	.07	.05	.29	.12	.35	.67	.34
7. Ag. Business Management	-.16	-.02	.12	.03	-.20	.10	.51

Note. Likert-type scales were summed to determine overall knowledge and comfort levels

Conclusions/Recommendations/ Implications

This study supports the importance of standardized guidelines to "aggregate, validate, test, and refine a contemporary list of professional competencies" (Joerger, 2002, p. 22). Texas mandates such guidelines in eight competency areas for all subjects in the agricultural science discipline. Bivariate analyses of the eight areas indicated a substantial positive relationship between pre-service teachers' knowledge and teaching comfort. As pre-service teachers' knowledge increased, so did their teaching comfort and vice versa, supporting Pajares and Miller's (1994) self-efficacy research. However, for seven of the eight comprehensive high school knowledge and skill areas, pre-service teachers perceived only adequate knowledge and teaching comfort, but having low knowledge and comfort in the soils and soil formation area.

Although we expected respondents' knowledge and teaching comfort to be highly associated, we also expected that pre-service teachers still in college would have *high* knowledge and teaching comfort for the state-mandated objectives. After all, they are expected to meet the state standards in their first teaching job. Thus, there is much concern about the respondents' preparatory programs because of their "adequate" to "low" knowledge and comfort for "general agricultural science and technology" areas. The findings indicate that pre-service teachers, in this study, needed more preparation in the eight areas essential to every agricultural education classroom. To increase their knowledge of the general agricultural science and technology areas, pre-service teachers need additional coursework and mastery of the state-mandated objectives to increase their teaching comfort levels.

Pre-service teachers had high perceived comfort teaching levels for TEKS objectives for which they had high perceived knowledge (i.e., employers' expectations, appropriate work habits, and good citizenship skills). Positive relationships existed between knowledge and teaching comfort levels in similar areas, such as in teaching animal science objectives. The results support Bandura's (1986) and Pajares and Miller's (1994) self-efficacy research: as self-perceived competence increases, so too increases beliefs in abilities to perform related tasks.

Positive relationships were found between dissimilar skill areas, such as between environment and agricultural business, food science and environment, and environment and agricultural mechanization. Additional research into these relationships should be conducted on similar populations from all universities with agricultural science teacher preparation programs to more fully explore the factors affecting these relationships.

Additional research in the concepts of pre-service teacher self-efficacy, confidence, and competence is needed to identify causal factors affecting the "less-than-desirable" knowledge and teaching comfort levels for the state-mandated general agricultural science and technology objectives. Specific emphasis is needed in studying the soils and soil formation area. Precisely, why were respondents' perceived knowledge and teaching comfort levels "low" for this skill area? Did they truly lack adequate coursework and practical experience in their agricultural science teacher preparation programs, or is this skill area no longer an integral part of teacher preparation programs in Texas?

The researchers recommend repeating this study to identify knowledge and teaching comfort levels for all teaching specialization areas in Texas. This line of inquiry provides statistical evaluation of pre-service teachers' preparedness in meeting the state-mandated objectives. Such new information could be used in crafting guidelines to implement programmatic changes to teacher education programs, allowing such programs to better address teachers' knowledge and/or teaching comfort in each topical area.

Response rates might have been higher had a larger population been available. Although valid e-mail addresses were secured, resulting in a 63% response rate, a greater response rate could have been achieved had our population been offered a social exchange incentive (e.g., 1-2 dollars) sent by postal mail with a cover letter and the introductory e-mail questionnaire hyperlink, versus the lottery incentive offered in this study (Dillman, 2000). However, the 63% response rate is much higher than a similar response rate (43.2%) from Texas agricultural science teachers after 22 days (Fraze et al., 2003).

Future studies employing true mixed methods (Fraze, et al., 2003; Ladner, et al., 2002) using postal mail and online survey techniques should be conducted to determine the most effective means for increasing social science questionnaire response rates.

References

Abbott, A. (2003). Transitions and careers: Mobility as process and outcome. *Proceedings of the Cornell Conference on Frontiers in Social and Economic Mobility*. Retrieved October 10, 2005, from http://www.inequality.com/events/papers/Abbott.pdf

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Borg, W. R., & Gall, M. D. (1989). *Educational research: An introduction* (5th ed.). New York: Longman.

Borich, G. D. (1980). Needs assessment model for conducting follow-up studies. *Journal of Teacher Education*, *31*(3), 39-42.

Cano, J., & Newcomb, L. H. (1990). Cognitive level of instruction and student performance among selected Ohio production agriculture programs. *Journal of Agricultural Education, 31*(1), 46-51.

Conroy, C. A., & Kelsey, K. D. (2000). Teacher education response to reinventing agricultural education for the year 2020: Use of concept mapping to plan for change. *Journal of Agricultural Education, 41*(1), 8-17.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297-334.

Davis, J. A. (1971). *Elementary survey analysis*. Englewood Cliffs, NJ: Prentice-Hall.

Deeds, J. P., Flowers, J., & Arrington, L. R. (1991). Cooperating teacher attitudes and opinions regarding agricultural education student teaching expectations and policies. *Journal of Agricultural Education, 32*(1), 2-9.

Dillman, D. (2000). *Mail and internet surveys: The tailored design method*. New York: John Wiley & Sons.

Dormody, T. J., & Torres, R. M. (2002). A follow-up study of agricultural education program graduates on teaching competencies. *Journal of Agricultural Education, 43*(4), 33-45.

Field, A. (2000). *Discovering statistics using SPSS for Windows: Advanced techniques for the beginner*. London: Sage.

Fraze, S. D., Hardin, K. K, Brashears, M. T., Haygood, J. L., & Smith, J. H. (2003). The effects of delivery mode upon survey response rate and perceived attitudes of Texas agri-science teachers. *Journal of Agricultural Education, 44*(2), 27-37.

Fritz, C. A., & Miller, G. S. (2003). Concerns expressed by student teachers in agriculture. *Journal of Agricultural Education, 44*(3), 47-53.

Harlin, J. F., Edwards, M. C., & Briers, G. E. (2002). A comparison of student teachers' perceptions of important elements of the student teaching experience before and after an 11-week field experience. *Journal of Agricultural Education, 43*(3), 72-83.

Joerger, R. M. (2002). A comparison of the inservice education needs of two cohorts of beginning Minnesota agricultural education teachers. *Journal of Agricultural Education, 43*(3), 11-24.

Kypri, K., Gallagher, S. J., & Cashell-Smith, M. L. (2004). An internet-based survey method for college student drinking research. *Drug and Alcohol Dependence, 76*, 45-53.

Ladner, M. D., Wingenbach, G. J., & Raven, M. R. (2002). Internet and paper based data collection methods in agricultural education research. *Journal of Southern Agricultural Education Research, 52*, 40-51.

McLean, R. C., & Camp, W. G. (2000). An examination of selected preservice agricultural teacher education programs in the United States. *Journal of Agricultural Education, 41*(2), 25-35.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*(4), 543-578.

Pajares, F., & Miller, D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology, 86*(2), 193–203.

Porter, S. R., & Whitcomb, M. E. (2003). The impact of lottery incentives on student survey response rates. *Research in Higher Education, 44*(4), 389-308.

Reardon, B. (2005, November 22). Recruiting, developing, and retaining quality career technical/workforce education (CTWE) teachers. Retrieved November 24, 2005, from http://www.nccte.org/webcasts/description.aspx?wc=186

Shelly-Tolbert, C. A., Conroy, C. A., & Dailey, A. L. (2000). The move to agriscience and its impact on teacher education in agriculture. *Journal of Agricultural Education, 41*(4), 51-61.

Singer, E. (2000). *The use of incentives to reduce nonresponse in household surveys*. Ann Arbor, MI: The University of Michigan Institute for Social Research, Survey Research Center. Retrieved October 24, 2005, from http://www.isr.umich.edu/src/smp/Electronic%20Copies/51-Draft106.pdf.

Texas Education Agency. (1998). Status of the curriculum. *1998 comprehensive biennial on Texas public school: Status of the curriculum*. Retrieved October 26, 2005, from http://www.tea.state.tx.us/reports/1998cmprpt/98report.5.pdf.

Texas Education Agency. (2005a). Chapter 119. Texas essential knowledge and skills for agricultural science and technology education: Subchapter B. Comprehensive, high school. *Texas Essential Knowledge and Skills*. Retrieved October 24, 2005, from http://www.tea.state.tx.us/rules/tac/chapter119/index.html.

Texas Education Agency. (2005b). Chapter 2 – The basics: Base indicators. *2005 Accountability Manual*. Retrieved November 15, 2005, from http://www.tea.state.tx.us/perfreport/account/2005/manual/.

Tuckman, B. W. (1999) *Conducting educational research.* Belmont, CA: Wadsworth.

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