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A Census of Baccalaureate Agriculture Teacher Education Program Requirements

R. G. (Tre) Easterly III[a], Christopher T. Stripling[b], Brian E. Myers[c]
[a]New Mexico State University, [b]University of Tennessee, [c]University of Florida

Abstract

The purpose of this study was to examine the nation's baccalaureate agriculture teacher education programs of study to synthesize current coursework requirements. Sixty-five baccalaureate programs of study were analyzed. The mean number of semester credit hours was 125.2, and the mean number of credit hours in the areas of professional knowledge, technical knowledge, and general knowledge were 37.8, 42.0, and 36.6, respectively. Great variability was found within these descriptive measures when observing the standard deviation, minimum and maximum values, and configuration of courses within each category. We recommend the profession engage in intense and deliberate conversations on how to best design programs of study at the national level. These conversations would provide the opportunity for the collective wisdom of the profession garnered through investigation of the literature and sharing of knowledge gained through personal experiences, which can be used to inform the decision making process at individual institutions.

Keywords: teacher education, preservice, coursework, teacher preparation, curriculum

Introduction

The primary aim of teacher education programs in agriculture is to train professionals to be successful agriculture teachers (Wardlow & Osborne, 2010). While the primary aim has been clear, the way to accomplish the task has been a source of debate. As early as 1912, Balcomb called for better training of agriculture teachers by reforming normal schools to better equip professionals entering the teaching profession. The passage of the Smith-Hughes Act in 1917 caused a drastic increase in the number of high school agriculture programs, and thus created a demand for teachers. This demand was met by converting teachers from other subjects, recruiting college of agriculture graduates, or hiring individuals from farms (Hillison, 1987). These teachers often lacked pedagogical training or the knowledge of agriculture to be successful (Hillison, 1987). The Smith-Hughes Act of 1917 made provisions for improving the training of agriculture teachers and creating a curricular balance. According to True (1929), ". . . teachers of agriculture should, therefore, have a broad training in the principles and methods of education and their applications to agriculture teaching, and in science, economics, and sociology, as well as in the science and practice of agriculture" (p. 378).

In 1988, the Committee on Agricultural Education in Secondary Schools, established by the National Research Council, proposed a dramatic change to agricultural education. The committee believed school-based agricultural education (SBAE) should be more than vocational

agriculture and needed to evolve to meet the diverse needs of the food and fiber industries and society. To meet these needs, the committee recommended the curriculum, SOEs (supervised occupational experiences or supervised agricultural experiences [SAE] today), and the FFA (The National FFA Organization) should not predominately be focused on production agriculture but rather ". . . prepare students more effectively for the study of agriculture in postsecondary schools and colleges and for current and future career opportunities in agricultural sciences, agribusinesses, marketing, management, and food production and processing" (National Research Council, 1988, p. 4). Specific to agriculture teacher education, the committee expressed programs should be revised and expanded to produce teachers with the knowledge and skills to provide meaningful learning experiences *in* and *about* agriculture.

According to the National Research Council (2009), ". . . academic institutions offering undergraduate education in agriculture should engage in strategic planning to determine how they can best recruit, retain, and prepare the agriculture graduate of today and tomorrow" (p. 5). Additionally, a variety of stakeholders should be involved in discussing how to prepare agriculture graduates and pilot-testing and continual assessment should be done to refine and improve academic offerings (National Research Council, 2009). In regards to agriculture teacher education, the literature on the competency needs by beginning SBAE teachers is well documented (e.g., Anderson, Barrick, & Hughes, 1992; Birkenholz & Harbstreit, 1987; Edwards & Briers, 1999; Joerger, 2002; Garton & Chung, 1996; Layfield & Dobbins, 2002; Myers & Dyer, 2004; Raven, Cano, Garton, & Shelhamer, 1993; Stripling & Roberts, 2012; Stair, Warner, & Moore, 2012; Stripling & Barrick, 2013), but few studies have looked at baccalaureate-level coursework requirements needed to prepare preservice SBAE teachers in those competencies. To that end, Myers and Dyer (2004) called for an investigation into the most effective coursework configuration for teachers. Similarly, Findlay (1992) stated the means in which agriculture teachers are being trained needs to be assessed.

In 1917, the requirements for teacher educators were 49 semester hours in technical agriculture, 40 in science, and 18 in psychology and education, with other courses in cultural subjects and electives to meet the total of 144 (True, 1929). In general education, Conant (1964) called for a review of training for all teachers which focused on obtaining competence in the various areas of teacher training. While admitting the competencies taught in the program were the most important aspect to consider, Conant provided recommendations for coursework configurations for specific teacher training programs. For biology teachers for example, Conant recommended 60 hours of general education, 3 hours of educational psychology, 3 hours of philosophy or history or sociology of education, 9 hours of additional science, 36 hours of biology courses, and 9 hours of practice teaching and special methods. In SBAE teacher preparation, Cruickshank (1985) divided coursework into either general education or professional education. Cruickshank et al. (1996) divided professional coursework into technical agriculture courses and professional knowledge, which created three main areas of coursework. Swortzel (1995) described the training for preservice teachers at The Ohio State University, which consisted of 46 semester hours of general education courses, 50 hours in technical agriculture and 37 hours in professional knowledge. In a survey of teacher education preparation programs, Swortzel (1999) found the 4-year programs on the semester system averaged 55.7 hours of courses in general studies, 42.8 hours in technical agriculture, and 35.8 hours in professional studies. According to Connors and Mundt (2001), 82% of agricultural education

programs are 4-year programs, 7 exist as 5-year programs, and one can either be a 4 or 5-year program. Furthermore, Connors and Mundt indicated 90% of the programs are on the semester system.

Finding a common curriculum amongst teacher preparation programs may prove to be difficult. McLean and Camp (2000) found that a set of common courses amongst agriculture teacher preparation programs does not exist. While there are some similarities between programs, agricultural education programs are designed and implemented on a local level with the needs of the students and community in that area in mind (Phipps, Osborne, Dyer, & Ball, 2008). Despite the diversity of the programs, in particular the courses required, McLean and Camp recommended professional courses include teaching methods, program planning, and foundations of agricultural education. A gap in the current literature exists in the number and type of technical knowledge, professional knowledge, and general knowledge courses offered and required of preservice teachers as well as the effectiveness of the current combination of courses required. Additionally, some agriculture teacher education programs have required courses combining technical knowledge with professional knowledge, and there is a lack of empirical data concerning the effectiveness of these courses.

Swortzel (1995) identified several components to consider when evaluating a teacher education program. According to Swortzel, the roles of an agriculture teacher education program are (a) to define the role of teachers, (b) design curriculum to prepare teachers for these roles, (c) determine appropriate instructional techniques to deliver curriculum, (d) provide appropriate facilities for learning, (e) select, recruit, and retain students, (f) select faculty members to train and prepare teachers, and (g) evaluate programs to determine their effectiveness. The focus of this inquiry was on Swortzel's (1995) second role of teacher preparation programs, which is to design curriculum to prepare teachers. Thus, the purpose of this study was to examine the nation's baccalaureate agriculture teacher education programs of study to synthesize current curricular requirements. We believe an understanding of the current configurations of coursework is important and necessary before the most effective configuration can be considered. Once this understanding of the current status is complete, an investigation of the effectiveness of these models can take place.

Conceptual Framework

The mission of agriculture teacher education programs is "teaching others to teach in agriculture" (Crawford, 1987, p. 5). While the settings in which others teach in agriculture have become more diverse, the original focus of training secondary teachers is still an important part of the mission of departments of agricultural education (Barrick, 1993). With this in mind, Barrick and Garton (2010) developed a model conceptualizing the teacher preparation curriculum (Figure 1), which identifies the variety of knowledge areas they believe should be developed or used to educate preservice agricultural education teachers. In addition, Barrack and Garton's model conceptualizes the components and progression of the most frequently occurring curriculum in the nation's agriculture teacher preparation programs.

At the base of the model is general education, which includes courses in content areas such as mathematics, natural sciences, social sciences, and art and humanities (Barrick & Garton, 2010; Swortzel, 1995). Cruickshank (1985) highlighted the need for teachers to have a

foundation of general education before being certified to teach, which results in making the teacher a well-rounded educator. One level above the base of the model is degree requirements such as meeting GPA minimums and college-wide employability skills required by colleges of agriculture or education (Barrick & Garton, 2010). The middle portion of the model includes coursework in a content specialty area (agriculture broadly defined in the context of this study), professional and pedagogical knowledge, and integrated studies. Swortzel (1995) identified the following content specialty areas SBAE teachers need to demonstrate competency in as: (a) production agriculture, (b) applied sciences as they relate to agriculture, (c) plant and soil science, (d) animal science, (e) agribusiness management, (f) agricultural mechanics, (g) natural resources, (h) forestry, and (i) marketing. Furthermore, according to Cruickshank (1985), "prospective teachers should be well prepared in the subject field they will teach and in related subjects, and they should know how to teach their subject" (pp. 106-107). Darling-Hammond and Bransford (2005) more explicitly defined the professional and pedagogical knowledge needed by teachers as the following:

- Knowledge of learners and how they learn and develop within social context;
- Conceptions of curriculum content and goals: an understanding of the subject matter and skills to be taught in light of the social purpose of education; and
- An understanding of teaching in light of the content and learners to be taught, as informed by assessment and supported by classroom environments. (p. 11)

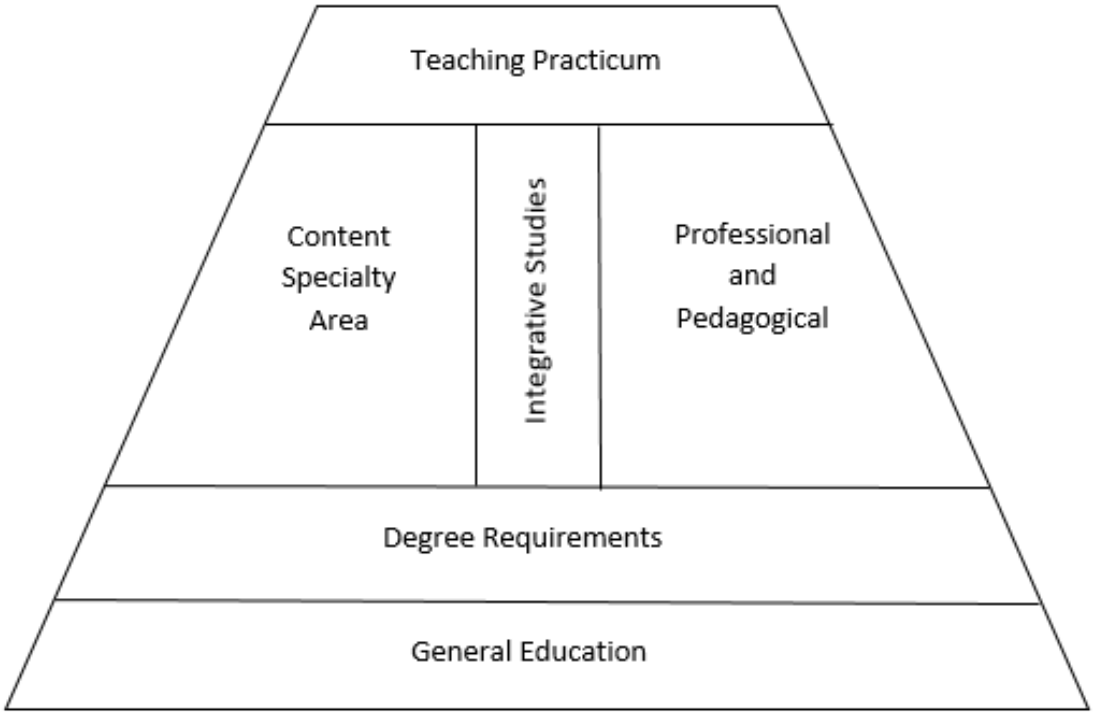

Figure 1. Barrick and Garton's (2010) model conceptualizing the teacher preparation curriculum.

According to Croom (2008), SBAE professional and pedagogical knowledge courses provide students with teaching methods and strategies for implementing instruction into the classroom and managing a complete agricultural education program, which includes incorporating SAE and

FFA. Integrative studies are courses involving both agricultural content and instruction on how to deliver content to students (Barrick & Garton, 2010). Cruickshank et al. (1996) highlighted the promise for integrative studies by stating "perhaps future teachers will have to synthesize and integrate content knowledge obtained from one group of academic faculty with pedagogical knowledge from teacher educators" (p. 12). At the top of the model is the capstone experience or teaching practicum, which is commonly referred to as the student teaching experience or internship (Barrick & Garton, 2010).

Purpose and Objectives

The purpose of this study was to examine the nation's baccalaureate agriculture teacher education programs of study to synthesize current curricular requirements. The course requirements were analyzed using Darling-Hammond and Bransford's (2005) description of the types of knowledge needed by teachers which was conceptualized by Barrick and Garton (2010). The following objectives guided this study:

1. Describe the professional knowledge (professional and pedagogical) coursework required by the nation's baccalaureate agriculture teacher education programs.
2. Describe the technical knowledge (content specialty area) coursework required by the nation's baccalaureate agriculture teacher education programs.
3. Describe the general knowledge (general education) coursework required by the nation's baccalaureate agriculture teacher education programs.

Methodology

Research Design

The research design for this descriptive study was a one-shot case study (Campbell & Stanley, 1963), which was conceptualized as a slice in time (Oliver & Hinkle, 1982). The target population for this study was all postsecondary institutions preparing SBAE teachers at the baccalaureate level. The supply and demand study by Kantrovich (2010) was used to help establish the sampling frame. Kantrovich described 72 programs that certify SBAE teachers and 17 non-respondents with a total of 89 programs. Institutions that incorporated SBAE teacher programs were added to the study based on the recent position announcements through the American Association for Agricultural Education listserve. Three institutions that opened a SBAE teacher preparation program since the supply and demand study, were added. One program was described as a state system in the Kantrovich study and was analyzed as two separate programs, because they were found to have unique degree plans. In a separate state, two programs in a state system were merged into one program because they offered identical degree plans. In total, there were 92 programs in the population frame for this study. Data were collected from 82 programs creating a response rate of 89.1%. Two of the non-respondent programs were also a non-respondent in the Kantrovich study. A total of eight programs responded to the study and indicated they do not currently have a SBAE teacher preparation program, yielding usable date from 74 total programs. Additionally, nine programs were removed because they only provided teacher certification at the post-baccalaureate level. Data from 65 programs were analyzed.

Data Collection Procedures

Programs of study were gathered from the university websites. The courses required for graduation outlined in the programs of study where then categorized by the researchers. The list was sent via email to an agricultural educator at each institution for verification of their program of study. The agricultural educator was purposefully selected by the researchers as an individual who is active in delivering instruction in the teacher education program. The detailed list was either approved by the individual, edited to reflect recent change in their program, or a change was made in classification of individual courses based on the content taught in the course. Follow-up emails and phone calls were made to programs who did not respond to the initial contact. Programs that did not provide verification or edits of their program of study were considered non-respondents and were not included in the data analysis.

Data Analysis

In the programs of study, required courses included individual courses needed to graduate, credit hours in a certain area or discipline, and total number of credit hours. Courses were categorized into professional knowledge, technical knowledge, general knowledge, integrative studies, electives, and other (see Table 1). Subcategories in professional knowledge were derived from the description of professional knowledge areas by Darling-Hammond and Bransford (2005) and Barrick and Garton's (2010) description of teaching practicum. Subcategories for technical knowledge were the eight Agriculture Food and Natural Resource (AFNR) program areas (National Council for Agricultural Education, 2009).

An agriculture leadership and communications subcategory was added to technical knowledge to account for leadership and communications coursework required by numerous programs. We discovered the need for this technical knowledge subcategory during data analysis. Subcategories for general knowledge were derived from Swortzel (1995). Barrick and Garton (2010) described courses in integrative studies, which was added as a separate section.

Table 1.
Example Courses in Each Area of the Programs of Study

Classification	Example Courses
Professional Knowledge	
Teaching Practicum - Student Teaching	Student Teaching
Teaching Practicum - Other	Early field experience (not integrated into other courses)
Knowledge of Learners and Their Development in Social Contexts	Educational Psychology, Multicultural Education, Educating Students with Special Needs
Knowledge of Teaching	Teaching methods, Assessment and Curriculum
Knowledge of Subject Matter and Curriculum Goals	Curriculum and Facilities Planning, Program Organization
Technical Knowledge	
Agribusiness Systems	Agricultural Marketing, Agricultural Economics

Animal Systems	Intro to Animal Science, Livestock Judging
Biotechnology Systems	Genetics, Agricultural Biotechnology
Environmental Service Systems	Agriecology, Environmental Technology
Food Products and Processing Systems	Intro to Food Science, Meat Science, Food Packaging
Natural Resource Systems	Soil Management, Rangeland Resources, Fish and Wildlife Management
Plant Systems	Plant Science, Plant Propagation, Botany
Power, Structural and Technical Systems	Rural Electrification, Construction Technology, Welding
Agricultural Leadership and Communication	Leadership Development, Communicating in Agriculture
General Knowledge	
Arts and Humanities	Composition Writing, English, Literature, Visual Arts, Performing Arts
Mathematics and Statistics	Algebra, Statistics, Trigonometry, Calculus
Natural Sciences- Physical	General Chemistry, Physics,
Natural Sciences- Life	Biology
Natural Science- Earth and Space	Geology, Astronomy
Social Sciences	Sociology, General Psychology, Cultural Issues
Integrative Studies	Greenhouses for teachers, Teaching Animal Science Concepts
Meets Two Knowledge Areas	
Technical and General Knowledge	Any course that met a requirement for more than one area (e. g. Floral Design as a Visual Arts Requirement and Plant Science)
Professional and General Knowledge[z]	

Note: [z] does not count toward total and is represented in either the technical or professional knowledge hours above and not general education.

Operational definitions for each of the constructs are provided in Table 2. Electives and other courses were added as coding categories for courses that were not appropriate for the knowledge areas or subcategories utilized during data analysis. After courses and requirements were categorized, a detailed list of courses was compiled for each program. Then the researchers compared the courses required to the total number of hours required for graduation. If the number did not match, the contact person at the university was asked to explain the discrepancy. Degree plans providing a range of hours for a particular area were extrapolated to the lowest number to represent the minimum number of hours required for that area.

The data were entered into Microsoft Excel, and means, standard deviations, modes, medians, and minimum and maximum values were calculated using formulas within the Microsoft Excel program.

Table 2.
Operational Definitions of Key Constructs

Construct	Operational Definition
Professional Knowledge	Coursework designed to provide teachers with the knowledge and skills needed to teach students from various backgrounds including pedagogical knowledge, which describes the knowledge teachers must possess in order that teachers are able to teach students in ways they can understand and learn the material (Barrick & Garton, 2010).
Technical Knowledge	Coursework in the agricultural sciences and natural resource areas that are designed to expose students to the array of subject knowledge they will be expected to teach in their classes (Barrick & Garton, 2010).
General Knowledge	Coursework designed to "help students gain knowledge and develop skills of analysis, synthesis, and evaluation essential to understanding intellectual ideas and principles; develop competence in written and oral communication; apply basic mathematical concepts and processes; gain an understanding of the natural and social sciences; and develop an appreciation of the arts, humanities, and cultural values, customs, and social interactions" (Barrick & Garton, 2010, pp. 36 - 37).
Integrative Studies	Clinical learning experiences that allow preservice teachers to combine professional knowledge with technical knowledge in an authentic learning experience (Barrick & Garton, 2010).

Results

A summary of total program of study credit hours in professional, technical, and general knowledge areas is presented in Table 3. The total mean number of program of study credit hours was 125.2 (*SD* = 5.3) with a minimum of 120 and a maximum of 144. The mode was 120 hours, and the median was 125 hours. The similarities in the mean, mode, and median produce a nearly perfect normal or symmetrical distribution of total program of study credit hours.
Table 3.

Baccalaureate Agriculture Teacher Education Programs of Study Requirements

Course Classification	*M*	*SD*	Mode	*Mdn*	Min/Max
Total Hours	125.2	5.3	120	125	120-144
Professional Knowledge	37.8	6.8	39	38	17-57
Teaching Practicum - Student Teaching	10.6	2.6	12	12	4-16
Teaching Practicum - Other	1.6	2.0	0	1	0-8
Knowledge of Learners and Their Development in Social Contexts	6.0	3.7	3	6	0-16
Knowledge of Teaching	10.2	4.1	12	10	3-21

Knowledge of Subject Matter and Curriculum Goals	9.4	3.9	6	9	0-18
Technical Knowledge	42.0	9.9	43	43	9-61
Agribusiness Systems	5.7	3.5	3	6	0-19
Animal Systems	6.1	3.8	6	6	0-18
Biotechnology Systems	0.4	1.1	0	0	0-6
Environmental Service Systems	0.7	1.4	0	0	0-6
Food Products and Processing Systems	0.7	1.4	0	0	0-6
Natural Resource Systems	4.4	2.8	4	4	0-16
Plant Systems	6.7	3.5	6	6	0-19
Power, Structural and Technical Systems	5.9	4.4	3	6	0-21
Agricultural Leadership and Communication	3.0	3.3	0	3	0-13
Agricultural or Natural Science Electives	8.3	8.6	0	6	0-36
General Knowledge[z]	36.6	8.4	35	35.5	3-54
Arts and Humanities	13.5	4.4	15	13	3-24
Mathematics and Statistics	4.7	2.0	3	5	0-12
Natural Sciences- Physical	4.8	2.5	4	4	0-12
Natural Sciences- Life	5.0	2.7	4	4	0-11
Natural Science- Earth and Space	0.1	0.7	0	0	0-4
Social Sciences	8.3	5.8	9	9	0-27
Electives[y]	5.9	9.7	0	0	0-45
Integrative Studies	0.8	2.4	0	0	0-17
Other	3.4	3.5	0	2	0-13
Meets Two Knowledge Areas[2]					
Technical and General Knowledge[2]	3.8	6.8	0	0	0-37
Professional and General Knowledge[2]	1.2	2.7	0	0	0-12

Note: [z] Ranges are skewed because one program listed general knowledge hours as 45 elective hours; [y] does not count toward total and is represented in either the technical or professional knowledge hours above and not general education.

Professional Knowledge Requirements

The first research objective was to describe the professional knowledge (professional and pedagogical) coursework required by the nation's baccalaureate agriculture teacher education programs. In this regard, the mean number of credit hours required was 37.8 (*SD* = 6.8) with a minimum of 17 and a maximum of 57 credit hours. Of the mean number of professional knowledge credit hours required, 10.6 (*SD* = 2.6) hours were for the student teaching practicum,

1.6 (*SD* = 2.0) hours were for teaching practicum other than student teaching such as early field experience and observation hours, 6.0 (*SD* = 3.7) hours for courses related to knowledge of learners and their development in social contexts, 10.2 (*SD* = 4.1) hours for courses focused on the knowledge of teaching, and 9.4 (*SD* = 3.9) hours for courses related to knowledge of subject matter and curriculum goals. Furthermore, the credit hours required in each subcategory in professional knowledge varied between 17-57 credit hours (See Table 3). Table 3 also provides the mode and median for each of the subcategories in professional knowledge.

Technical Knowledge and Required Coursework

The second research objective was to describe the technical knowledge (content specialty area) coursework required by the nation's baccalaureate agriculture teacher education programs. In this case, the mean technical knowledge credit hours required by the nation's baccalaureate agriculture teacher education programs was 42.0 (*SD* = 9.9). Plant systems was the highest subcategory (*M* = 6.7, *SD* = 3.5) followed by animal systems (*M* = 6.1, *SD* = 3.8), power, structural and technical systems (*M* = 5.9, *SD* = 4.4), and agribusiness systems (*M* = 5.7, *SD* = 3.5). On average, programs of study required 8.3 (*SD* = 8.6) credit hours of agricultural or natural science electives. Biotechnology systems, environmental service systems, and food products and processing systems averaged less than one credit hour with credit hours required from zero to six. The mode and median for each of the subcategories in technical knowledge can be found in Table 3.

General Knowledge and Required Coursework

The third research objective was to describe the general knowledge (general education) coursework required by the nation's baccalaureate agriculture teacher education programs. About this category of coursework described in this study, general knowledge, the mean credit hours required by the nation's baccalaureate agriculture teacher education programs was 36.6 (*SD* = 8.4). The mean number of credit hours required in the general knowledge subcategories was as follows: (a) arts and humanities (*M* = 13.5, *SD* = 4.4), (b) social science (*M* = 8.3, *SD* = 5.8), (c) natural science – life sciences (*M* = 5.0, *SD* = 2.7), (d) natural science – physical sciences (*M* = 4.8, *SD* = 2.5), (e) mathematics and statistics (*M* = 4.7, *SD* = 2.0), and (f) natural science – earth and space (*M* = 0.1, *SD* = 0.7). The mode and median for each of the subcategories in general knowledge can be found in Table 3.

Of the professional, technical, and general knowledge credit hours mentioned above, an average of 3.8 (*SD* = 6.8) hours of coursework met both technical and general knowledge requirements as well as 1.2 (*SD* = 2.7) hours of coursework met both professional knowledge and general knowledge requirements (See Table 3). Also, the mean number of credit hours for electives, integrative studies, and other courses that did not fit in the knowledge areas or subcategories utilized was 5.9 (*SD* = 9.7), 0.8 (*SD* = 2.4), and 3.4 (*SD* = 3.5), respectively.

Conclusion, Implications, and Recommendations

This study sought to describe the programs of study for the nation's baccalaureate-level agriculture teacher education programs. This purpose was addressed by the collection and

examination of programs of study from 65 institutions from across the country. The mean number of semester credit hours included in these programs was 125.2 credit hours. Further, we determined the mean number of credit hours in the areas of a teacher education program of professional knowledge, technical knowledge, and general knowledge were relatively equivalent at 37.8, 41.8, and 36.3, respectively, which was similar to Swortzel's (1999) findings. In this regard, it is important to note the measures of central tendency (mean, median, and mode) indicate the total degree program credit hours, professional knowledge credit hours, technical knowledge credit hours, and general knowledge credit hours all have a near normal or symmetrical distribution. If only investigating these descriptive measures, one may conclude there is great similarity amongst the programs of study at all the agriculture teacher education degree-granting institutions, however, deeper investigation into the data shows heterogenic programmatic offerings.

While the measures of central tendency were homogeneous, a normal distribution does not indicate consensus of programs in the profession. Variability was found when observing the standard deviation and minimum and maximum values of each category of total credit hours (*SD* = 5.3; 120-144); professional knowledge (*SD* = 6.8; 17-57); technical knowledge (*SD* = 9.9; 9-61), and general knowledge (*SD* = 8.4; 3-54). Therefore, one can conclude the profession of agriculture teacher education has not yet come to full agreement, at least in practice, as to the appropriate configuration of a teacher preparation degree program. These measures of variability would indicate there are some programs that could be considered outliers regarding the programs of study they require for their program graduates. Additionally, the configuration of courses within each of the major categories of the degree program vary greatly across all programs. This difference is most evident in the required courses within the technical knowledge category with many programs specifically outlining certain competency areas (i.e., animal systems, plant systems, etc.), and others providing few or no guidelines for courses to be completed within this category. Biotechnology systems, environmental service systems, and food processing systems were the three lowest means for courses in the AFNR areas. Interestingly, Stripling, Thoron, and Estepp (2014) found 78.6% and 42.9% of preservice teachers in Florida felt unprepared in biotechnology and food science technical knowledge, respectively. In addition, 50% of the preservice teachers reported being unprepared to teach biotechnology and food science. Further investigation is needed to determine if coursework in these areas should be increased to meet the needs of the nation's preservice teachers and SBAE programs.

Integrative studies were identified by Barrick and Garton (2010) and outlined in the conceptual model of this study. The mean of 0.8 credit hours in this area indicates that these courses are not as pervasive as other areas. Further research is needed to investigate the success of the integrative courses being offered, to determine the barriers for offering integrative courses, and to ultimately determine the effectiveness of including integrative courses as part of a teacher education curriculum.

We acknowledge many of the decisions regarding the configuration of the program of study for agriculture teacher education at each institution are heavily impacted by state teacher certification requirements and university-wide requirements. However, the question is raised, *Is there a program of study configuration that is more effective at producing quality agriculture teacher education graduates than others*? The findings of this manuscript contribute little to the

answer to that question. However, these findings do establish a baseline for programs to use when making changes to degree programs. This study also provides a detailed baseline for future inquiries. We encourage future inquiry to investigate the ideal makeup of coursework for teacher preparation programs. We also recommend the results of this study be used by the profession to engage in intense and deliberate conversations on how to best design programs of study at the national level. These conversations would provide the opportunity for the collective wisdom of the profession garnered through investigation of the literature and sharing of knowledge gained through personal experiences, which can be used to inform the decision making process at individual institutions.

Now that the current status has been described, we echo the call of Findlay (1992) and Myers and Dyer (2004) to assess the training of agriculture teachers by determining the most effective configuration of courses. The next logical step in this line of inquiry is to conduct investigations to empirically determine the ideal blend of programmatic courses in an agriculture teacher education program. Specific studies should be conducted to determine the most appropriate competencies to include in each area. Future studies should be conducted to examine the most appropriate blend of professional knowledge courses, including the timing and sequencing of field experiences, the structure and source of courses related to the knowledge of learners and development in their social context, and the ideal sequence of courses that inform the knowledge of teaching and the knowledge of subject matter and curriculum goals. Future studies should also investigate the effect of completing a specialization in technical knowledge courses and/or a diverse offering of technical courses. Furthermore, future studies should investigate the role of general knowledge courses as they relate to imbedding concepts related to STEM, history, and social science in the agriculture curriculum. Lastly, other agricultural disciplines should undertake comparable lines of inquiry to test new ideas and refine/improve academic offerings (National Research Council, 2009).

References

Anderson, T. J., Barrick, R. K., & Hughes, M. (1992). Responsibilities of teacher education for vocational teacher professional development programs. *Journal of Agricultural Education, 33*(2), 43–50. DOI: 10.5032/jae.1992.02043

Balcomb, E. E. (1912). The place of the normal school in agricultural education. In: *Journal of Proceedings and Addresses of the Fiftieth Annual Meeting of the National Education Association of the United States*, Chicago, IL: 6-12 Jul.

Barrick, R. K. (1993). A conceptual model for a program of agricultural education in colleges and universities. *Journal of Agricultural Education, 34*(3), 10–16. doi: 10.5032/jae.1993.03010.

Barrick, R. K., & Garton, B. L. (2010). Frameworks for agricultural teacher preparation. In R. M. Torres, T. Kitchel, & A. L. Ball (Eds.), *Preparing and advancing teachers in agricultural education* (pp. 30-41). Columbus, OH: Curriculum Materials Service, The Ohio State University.

Birkenholz, R. J., & Harbstreit, S. R. (1987). Analysis of the inservice needs of beginning vocational agriculture teachers. *Journal of the American Association of Teacher Educators in Agriculture, 28*(1), 41–49. DOI:10.5032/jaatea.1987.10041

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research.* Boston, MA: Houghton Mifflin Company.

Conant, J. B. (1964). *The education of American teachers*. New York, NY: McGraw-Hill Book Company.

Connors, J. J., & Mundt, J. P. (2001, December). *Characteristics of preservice teacher education programs in agricultural education in the United States*. Paper presented at the 28th Annual National Agricultural Education Research Conference, New Orleans, LA.

Crawford, H. R. (1987). Managing our advantages in agricultural education. *The Journal of the American Association of Teacher Educators in Agriculture, 28*(1), 2–8, 16. doi: 10.5032/jaatea.1987.01002.

Croom, D. B. (2008). The development of the integrated three-component model of agricultural education. *Journal of Agricultural Education, 49*(1), 110–120. doi: 10.5032/jae.2008. 01110.

Cruickshank, D. R. (1985). *Models for the preparation of America's teachers*. Bloomington, IN: Phi Delta Kappa Education Foundation.

Cruickshank, D. R., Bainer, D., Cruz, J., Giebelhaus, C., McCullough, J. D., Metcalf, K. K., & Reynolds, R. (1996). *Preparing America's teachers*. Bloomington, IN: Phi Delta Kappa Education Foundation.

Darling-Hammond, L., & Bransford, J. (2005). *Preparing teachers for a changing world*. San Francisco, CA: Jossey-Bass.

Edwards, M. C., & Briers, G. E. (1999). Assessing the in-service needs of entry-phase agriculture teachers in Texas: A discrepancy model versus direct assessment. *Journal of Agricultural Education, 40*(3), 40–49. doi: 10.5032/jae.1999.03040.

Findlay, H. J. (1992). Where do secondary vocational agriculture teachers acquire professional agricultural education competencies? *Journal of Agricultural Education, 33*(2), 28–33. doi: 10.5032/jae.1992.02028.

Garton, B. L., & Chung, N. (1996). The in-service needs of beginning teachers of agriculture as perceived by beginning teachers, teacher educators, and state supervisors. *Journal of Agricultural Education, 37*(3), 52–58. doi: 10.5032/jae.1996.03052.

Hillison, J. (1987). Agricultural teacher education proceeding the Smith-Hughes Act. *The Journal of Agricultural Education, 28*(2), 8–17. DOI: 10.5032/jaatea.1987.02008

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), 11–22. doi: 10.5032/jae.2002.03011.

Kantrovich, A. J. (2010). *The 36th volume of a national study of the supply and demand for teachers of agricultural education 2006-2009*. West Olive, MI: Michigan State University.

Layfield, K. D., & Dobbins, T. R. (2002). Inservice needs and perceived competencies of South Carolina agricultural educators. *Journal of Agricultural Education, 43*(4), 46–55. doi:10.5023.jae.2002.04046

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. doi: 10.5032/jae.2000.02025.

Myers, B. E., & Dyer, J. E. (2004). Agriculture teacher education programs: A synthesis of the literature. *Journal of Agricultural Education, 45*(3), 44–52. doi: 10.5032/jae.2004.03044.

National Council for Agricultural Education. (2009). National agriculture, food and natural resources (AFNR): Career cluster content standards. Retrieved from https://ffa.learn.com/files/pdf/FINAL_AFNR_Standards_v3_2_4_6_09.pdf

National Research Council. (1988). *Understanding agriculture: New directions for education*. Washington, DC: National Academy Press.

National Research Council. (2009). *Transforming agriculture education for a changing world*. Washington, DC: National Academies Press.

Oliver, J. D., & Hinkle, D. E. (1982). Occupational education research: Selecting statistical procedures. *Journal of Studies in Technical Careers, 4*(3), 199–208.

Phipps, L. J., Osborne, E. W., Dyer, J. E., & Ball, A. (2008). *Handbook on agricultural education in public schools* (6th ed.). Clifton Park, NY: Thomson Delmar Learning.

Raven, M. R., Cano, J., Garton, B. L., & Shelhamer, V. (1993). A comparison of learning styles, teaching styles, and personality styles of preservice Montana and Ohio agriculture teachers. *Journal of Agricultural Education, 34*(1), 1–10. doi: 10.5032/jae.1993.01001

Stair, K. S., Warner, W. J., & Moore, G. E. (2012). Identifying concerns of preservice and in-service teachers in agricultural education. *Journal of Agricultural Education, 53*(2), 153–164. doi: 10.5032/jae.2012.02153.

Stripling, C. T., & Barrick, R. K. (2013). Examining the professional, technical, and general knowledge competencies needed by beginning school-based agricultural education teachers. *Journal of Agricultural Education, 54*(3), 67–83. doi: 10.5032/jae.2013.03067.

Stripling, C. T., & Roberts T. G. (2012). Florida preservice agricultural education teachers' mathematics ability and efficacy. *Journal of Agricultural Education, 53*(1), 109–122. doi: 10.5032/jae.2012.01109

Stripling, C. T., Thoron, A. C., & Estepp, C. M. (2014). Learning activities utilized and readiness for the student teaching internship. *Journal of Agricultural Education, 55*(4), 148–161. doi: 10.5032/jae.2014.01418

Swortzel, K. A. (1995). Program for the preparation of preservice agricultural education teachers for the twenty-first century. (ERIC Document Reproduction Service No. ED 389 676).

Swortzel, K. A. (1999). Current status of preservice teacher education programs in agriculture. *North American Colleges & Teachers of Agriculture Journal, 43*(1). Retrieved from http://www.nactateachers.org/vol-43-num-1-march-1999/637-current-status-of-preservice-teacher-education-programs-in-agriculture.html.

True, A. C. (1929). *A history of agricultural education in the United States: 1785-1925.* Washington, DC: United States Department of Agriculture

Wardlow, G. W., & Osborne, E. W. (2010). Philosophical underpinnings in agricultural education. In Torres, R., T. Kitchel, & A. Ball (Eds.), *Preparing and advancing teachers in agricultural education* (pp. 16-29). Columbus, OH: The Ohio State University Curriculum Materials Service.

AUTHORS' NOTES

R. G. (Tre) Easterly III is an assistant professor in the Department of Agricultural and Extension Education at New Mexico State University in Las Cruces, NM. The author can be contacted at easterly@nmsu.edu.

Christopher T. Stripling is an associate professor and undergraduate coordinator in the Agricultural Leadership, Education and Communications department at the University of Tennessee in Knoxville, TN. The author can be contacted at cstripli@utk.edu.

Brian E. Myers is professor and chair of the department of Agricultural Education and Communication at the University of Florida in Gainesville. The author can be contacted at bmyers@ufl.edu.

Appendix A: Baccalaureate Programs of Study

Institution	Institution
Alabama A&M University	Stephen F. Austin State University
Alcorn State University	Sul Ross State University
Arkansas State University	Suny Oswego
Auburn State University	Tarleton State University
Cal Poly Pomona*	Tennessee State University
Cal Poly San Luis Obispo*	Tennessee Tech University
California State University Chico*	Texas A&M University
California State University Fresno*	Texas A&M University Commerce
Clemson University	Texas A&M University Kingsville
College of the Ozarks	Texas State University
Colorado State University	Texas Tech University
Cornell University	The Ohio State University
Delaware State University	The University of Maryland E. Shore
Eastern Kentucky University	The University of Puerto Rico
Eastern New Mexico University	Tuskegee University
Florida A&M University	University of California- Davis*
Fort Valley State University	University of Arizona
Illinois State University	University of Arkansas
Iowa State University	University of Connecticut
Kansas State University	University of Delaware
Louisiana State University	University of Florida
Louisiana Tech University	University of Georgia
Michigan State University*	University of Hawaii
Middle Tennessee State University	University of Idaho
Mississippi State University	University of Illinois
Missouri State University	University of Kentucky
Montana State University Bozeman	University of Maryland
Morehead State University	University of Massachusetts
Mount Olive College	University of Minnesota
Murray State University	University of Missouri
North Carolina A&T State University	University of Nebraska Lincoln
New Mexico State University	University of Nevada Reno
North Carolina State University	University of New Hampshire
North Dakota State University	University of Southwestern Louisiana
NW Missouri State University	University of Tennessee- Knoxville
Oklahoma Panhandle State University	University of Tennessee- Martin
Oklahoma State University	University of Wisconsin- Platteville
Oregon State University*	University of Wisconsin- River Falls
Penn State University	University of Wyoming
Purdue University	Utah State University
Rutgers University*	Virginia Tech*
Sam Houston State University	Washington State University

South Dakota State University
Southern Arkansas University
Southern Illinois University

Southern University
West Texas A&M University
West Virginia University
Western Illinois University
Western Kentucky University

* Indicates programs that certify teachers beyond the baccalaureate level or as a minor and were excluded from the data analysis in this study