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Development of Basic Meat Science Curriculum Standards for Secondary Agricultural Education: Delphi Model

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DEVELOPMENT OF BASIC MEAT SCIENCE STANDARDS FOR SECONDARY AGRICULTURAL EDUCATION: DELPHI MODEL

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ABSTRACT

The purpose of this study was to develop basic meat science topics and standards for secondary agricultural education. A Delphi panel was used to develop the instrument. The Delphi panel was composed of four members from academia and industry and four from the top ten national meat FFA Career Development Events coaches from 2000 to 2005. Two Delphi rounds were used to develop the survey instrument. The modified Delphi started with an outline of basic meat science topics developed by an expert panel from 16 university basic meat science syllabi. The Delphi panel added or deleted topics, topics were consolidated into an outline, and a Likert-type scale added. Topics with a mean < 2.5 were removed. Standards were added to each topic, standards were combined, and a Likert-type scale added. The initial 136 standards were reduced to 100, by removing duplicate, similar and those not clear. Agricultural education teachers from six southern states were asked to validate each standard using a Web-based survey with a drop-down menu of 4 = high, 3 = moderate, 2 = low, and 1 = not a priority. The study found 17 topics (38%) having moderate to high priority with a mean > 3.0, eight (32%) topics having low priority with a mean of < 3.0 but > 2.0, and no topics were rated not a priority. All topics had a SD ≤ 1.0 confirming a high level of agreement among agricultural education teachers, giving a basis for developing a basic meat science curriculum for secondary agricultural education.

Keywords: curriculum, Delphi, education, standards, topics

DEDICATION

I dedicate this dissertation to the memory of my father Dr. Albert L. Duke and my mother Gretchen K. Duke for all their support and guidance in the completion of my studies throughout my life.

To Dr. George C. Skelley Jr. for all his support in my professional development in the area of Animal Science with the emphasis in Meat Science and his assistance on my master's and doctoral research.

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CHAPTER I

INTRODUCTION

Overview

As we venture into the 21st century, the need has arisen for Food Safety and Preparation Education. According to Rasmussen (1989) in 1850, 11,680,000 farm residents made up 50 percent of the population and 64 percent of the labor force (p. 20). In 1918, Secretary of Agriculture David F. Houston reported on the first year's operation of the Smith-Leaver Act. He stated that "women county agents" had worked on topics related to the physical well-being of families - home conveniences, eradication of flies and mosquitoes, proper preparation of food, care of poultry, and marketing of eggs. Approximately 50,000 homes had been visited, and those families had been given helpful suggestions. Six thousand farm women had presented special demonstrations in home improvements to fellow homemakers (p. 154). As we grew through the 20th century, we had a significant societal change in the family structure. More women wanted to and were required to work outside the home to help maintain fiscal responsibility. This contributed to a generation of people who are uneducated about home economics, food safety, and basic survival techniques (p. 155). Without strong home instruction in food safety and preparation, it is necessary for instruction to occur at the secondary school level.

History of American Agriculture: Agricultural Education & Extension lists several events that contributed to the development of agricultural education: The Morrill Acts of 1862 and 1890 were the first major acts of legislation to address the problem of

societal difference in education with the establishment of land grant institutions. With passing of the Smith-Hughes Act of 1917, vocational education changed significantly. This allowed federal money to go into state coffers, allowing the average individual to attend institutes of higher learning, previously only available to the elite of society. As we continued through the 20th century, several other acts of legislation were passed to benefit vocational education. These acts included the George-Dean Act of 1934, the National Defense Education Act of 1958, the Vocational Education Act of 1963, and the Carl D. Perkins Vocational Education Act of 1984.

The George-Dean Act of 1934 supplemented the areas of agriculture, home economics, trade, and industrial education. The National Defense Education Act of 1958 responded to the launching of the Russian satellite Sputnik. This event put current technical and scientific education under the microscope which resulted in a miserable failure. Congress was appalled at the results and passed legislation addressing the problem. The Vocational Education Act of 1963, also known as the Perkins-Morse bill, affirmed the federal government's commitment to vocational education as an essential part of the common welfare and defense of the country, giving technical and industrial education a needed economic boost. The Vocational Education Amendments of 1967 basically cancelled all previous legislation except the Smith-Hughes Act, which was retained as the first legislation for vocational education at the secondary level. The Carl D. Perkins Vocational Education Act of 1984 showed a philosophical change in Congress. The importance of vocational educational was realized by Congress with the administration handled at the local level (http://www.agclassroom.org/gan/timeline/ag_ed.htm).

Hewitt (2006) stated that, concerning schools and schooling, there are two familiar contemporary examples. The report of the National Commission on excellence in Education of 1983, *A Nation at Risk,* initiated a national school reform movement that took different forms depending on how political parties and interest groups coalesced on particular aspects of the report. The legacy of that report, the impetus to and emphasis on reform, continues today. The importance of the report was not its effect on direct policy making but promoting different approaches to reform rather than using the governing apparatus of the state and the law. That changed with the most recent reform initiative, the No Child Left Behind (NCLB) Act of 2001, signed into law in 2002. This act is the latest reincarnation of the Elementary and Secondary Education Act dating from the 1960s. The NCLB Act is a comprehensive accountability program based on extensive testing and increased financial support for schools meeting particular mandates such as developing curriculum standards, establishing comparative student performance levels across states, and assuring teacher quality in the areas of curriculum expertise. Reform, standards, associated coats, and the NCLB Act are major educational policy issues with important curriculum implications. The importance is the shift from policy initiatives resulting from reports and reformers to direct policy making by law (pp. 54-55).

Background for this Study

Vocational education needs have changed significantly over the 20th century with the current migration of young people off the farms. Therefore, a need has arisen for the development of educational techniques in the curriculum of basic meat science. Meat science has grown extensively in the area of technology during the 20th century. The

food science industry is a billion dollar a year industry. While several two-year institutions, four-year colleges and universities offer meat science courses and degrees, this is a new concept at the secondary school level (Stuska, 1993). According to Rasmussen (1989) changes of the 20th century, developed the need for changes in agricultural education. Farmers need more technical education to fill the agricultural needs of the 21st century. The farm labor force has decreased significantly and family farms have given away to corporate farms. Children of farmers are moving from rural to urban areas. With the constant change in agricultural education, we need to have in place a more effectively trained workforce for the high tech agriculture industry of today. This educational groundwork will need to start at the secondary school level (pp. 3-4). Currently there is not a nationally recognized basic meat science curriculum; however, several states do have a basic meat science curriculum.

CDC reports weekly of microbial outbreaks in foods and how this affects the safety of the general public:

> CDC's Outbreak Net Team conducted a multi-state case-control study in collaboration with health authorities in Ohio and Michigan to epidemiologically (the branch of medical science concerned with the occurrence and control of disease in populations) examine exposures that might be related to illness. The data indicate a significant association between illness and eating ground beef purchased at one of several Kroger® stores in Michigan and Ohio. CDC has provided these results to USDA-FSIS and public health agencies in Michigan and Ohio (retrieved 25 Aug 2008) http://www.cdc.gov/ecoli/june2008outbreak/index_071608.html (Appendix Q).

The American Meat Institute reports in their March issue of The United States Meat Industry.

> In 2007, more than 506,000 workers were employed in the meat and poultry packing and processing industries. Their combined salaries total more than $12.8 billion. The half million U.S. meat and poultry workers par approximately $1.5 billion in federal payroll taxes and $1.4 billion in Social Security taxes. Meat and poultry industry sales are vital to the economy. In 2006, meat and poultry industry sales topped $142 billion. In addition to the $142 billion in sales, there are millions of dollars worth of goods ands services generated by the industry's ripple effect, including jobs in packaging, transportation, manufacturing and retail.
>
> The meat and poultry industry is the largest segment of U.S. agriculture. Total meat and poultry production in 2007 reached more than 91 billion pounds processing 9 billion chickens, 271 million turkeys, 109 million hogs, 34.2 million cattle, 2.7 million sheep and lambs. In 2007, Americans on average, consumed 86.3 pounds of chickens; 65 pounds of beef; 50.5 pounds of pork; and 17.5 pounds of turkey. (http://www.meatami.com/ht/a/GetDocumentAction/i/47508

Problem Statement

In today's world, concern with food safety is an everyday issue and occurrence. Thus, development and evaluation of basic meat science curriculum standards at the secondary agricultural school level is essential. Consideration of sanitation, preparation, carcass handling, meat processing, meat fabrication (cutting), and carcass harvesting is essential and needs to be validated in a basic meat science curriculum.

Purpose and Objectives

The purpose of this study is to develop a list of meat science topics and standards for a basic meat science curriculum in secondary agricultural education using a Delphi Panel and agricultural education teachers. The Delphi panel participants were selected from industry and academia. Teacher representatives were current agricultural education

teachers from six southern and Mid-Atlantic states—Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

The following objectives were established in conducting this research:

1. develop basic meat science topics for a basic meat science curriculum at the secondary agricultural education school level,

2. develop a list of standards under each topic far a basic meat science curriculum at the secondary agricultural school level and,

3. have standards validated by current agricultural education teachers who teach Animal Science and/or Animal Production courses.

Definitions

Career Development Event (CDE): Since 1928, FFA has worked to create CDEs that demonstrate the meaningful connections between classroom instruction and real-life scenarios. CDEs build on what is learned in agricultural classes and the FFA (ffa.org).

Competencies: Reflects the ability to do something in contrast with the more traditional ability to demonstrate knowledge. Specifically, competencies for vocational and technical education are those tasks skills, attitudes, values, and appreciations that are deemed critical to success in life and/or in earning a living. Just because something is performed by a worker does not mean that it is automatically classed as a competency. The worker must, in fact, find this competency to be a critical aspect of employability in the occupation. Each competency, then, evolves from explicit statements of worker roles, and, since competencies align so closely with an occupation, student competence is ultimately assessed in much the same way as that of a co-worker. In order to ensure that assessment will be fair to the student, all competencies are detailed and made available for anyone to examine (Finch and Crunkilton," 1999, p. 259-260).

Curriculum: "The sum of the learning activities and experience that a student has under the auspices or direction of the school (Finch and Crunkilton," 1999, p. 11).

Delphi Technique: A research method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (Linstone and Turoff, 1975).

Expert: An individual having special skills or knowledge derived from training or experience (Gove, 1981). The operational definition of an expert for this study is an individual who works with and teaches basic meat science courses at the post-secondary level.

Likert-type Scale: A scale that involves having subjects rank their responses on a range of numbers, i.e., on a scale of 1 to 4.

Meat Industry: Inclusive of all areas that deal with the production, harvest, fabrication, processing, preparation, production and safety of food animals used in the consumer food chain.

Objectives: Provided here are specific statements of performance the student should be able to demonstrate while progressing through the module and when completing it. Terminal and enabling objectives specify the activities to be preformed, the conditions under which they are to be performed, and the levels of acceptable performance (Finch and Crunkilton, 1999, p. 259).

Secondary School: High schools usually consisting of grades 9-12 or 10-12.

Standards-based Education: The development of educational practices based on (a) a clearly stated and measurable description of what students are to know and do as a result of schooling, (b) a curriculum allowing students to meet that description, and (c) assessments to validate student achievement or attainment levels (Hewitt, 2006, p. 417).

Standards: Benchmarks used to validate curriculum based on students needs.

Vocational Education: A program that "encompasses a tremendous number of programs designed to prepare students for employment and for living" (Scott and Sarkees-Wircenski, 1996, p. 2)

Limitations of the Study

This was a regional study, which developed the topics and standards for a basic meat science curriculum for agricultural education programs in secondary schools. Study data were collected from a Delphi panel made up of experts in the field of meat science and agricultural education teachers. Certain inherent limitations occurred in the study and were taken under consideration at the conclusion of the study:

1. topics and standards may be subject to bias, as consideration of the ability of experts and Delphi panels, accuracy, and objectivity of responses were not validated;

2. teachers had different levels of expertise when they validate the standards; and

3. the study involved only six states thus limiting broader assumptions.

CHAPTER II

REVIEW OF THE LITERATURE AND RELATED RESEARCH

Overview

Vocational education has gone through major changes since the Smith-Hughes Act of 1917 established vocational education. The first major change was conceptual—from a production-based curriculum to a more technical and consumer-driven curriculum. Throughout the 20th century, society metamorphosed due to technological and technical advances that occurred. The Industrial Revolution created more jobs than there were workers to fill these jobs. In the early part of the century, a majority of the work force worked and lived on farms or ranches. By the end of the century, a majority worked in factories and lived in an urban environment. This resulted in a great migration of workers from the farm to factories. This metamorphosis created a need to educate the masses in technological skills. Vocational education needed to change or be left behind. They changed but not without a fight. The Smith-Hughes Act was cited as a law prohibiting change. However, cooler heads prevailed and by the end of the 20th Century vocational education would change to vocational and technical education, then later to career and technical education, embracing the change from the horse to the tractor and beyond. According to Rasmussen (1989):

> Cooperation is the hallmark of Extension's relations with people. Its educational programs are available to anyone who wishes to participate, but no one is forced to take part. Within this voluntary cooperative framework, Extension, drawing upon research-based knowledge, teaches people to identify problems, to analyze information, to decide among alternative

> courses of action for dealing with those problems, and to locate the resources to accomplish a preferred course of action. The educational programs it undertakes most often arise as a response to needs identified on the local level. In addition to basic educational programs, Extension staff members and volunteers meet local needs by organizing such activities as weed and insect identification clinics, providing materials on the conservation of natural resources, distributing information about diet and health, and encouraging participation, especially by youth, in the educational aspects of county and state fairs (p. 5).

History of Agricultural Education

Early Agricultural Education (1600-1860)

Scott and Sarkees-Wircenski noted in Appendix B:

> In 1647, Massachusetts passed a law requiring every town of 50 households to hire a schoolmaster to teach reading and writing. A town of 100 households was required to establish a Latin grammar school to prepare selected youngsters for college.

From extensive research, Eliot (2008) compiled his *Essays upon Field-Husbandry in New-England*, which was published in six parts from 1748 to 1759. Those essays became the most popular and prominent works on agronomy published in the English colonies before the American Revolution. Eliot sought to advance scientific techniques of agriculture, to improve farm production, and also to restore seemingly exhausted soils and to promote the planting cover crops (Eliot, 2008).

A History of American Agriculture Timeline (2008) records the following events:

> From 1800 to 1829, agricultural periodicals were published expressing the views and needs of rural America. The popularity of these periodicals, their ability to inform the public, developed a need to educate the people in the basics of agriculture. From 1825 to 1850, several schools started introducing course work in agriculture and science directly related to agriculture. The movement of public schools gained momentum in the 1830s.

> Between 1830 and 1860, public and agricultural education was the most prominent rural issue of the period, especially in the North. In 1840, agricultural journalism was permanently established in the United States, with around 30 farm journals, with a total circulation of over a 100,000. In 1855, Michigan and Pennsylvania passed legislation to establish Michigan Agriculture College and the Farmers High School, later known as Pennsylvania State College (http://www.agclassroom.org/gan/timeline/ag_edu.htm).

Morrill Land Grant Act

Prior to 1862, the only people in the United States able to go to college were the upper class. This was based on both their social and financial status in the community. As the country started to grow and heal after the Civil War, a need arose to educate the people in the areas of agriculture and mechanics. President Abraham Lincoln stated "The land-grant university system is being built on behalf of the people, who have invested in these public universities their hopes, their support, and their confidence" (History of Our Nation's Land Grant University's: slide 7). In 1862, Congress enacted The Morrill Land Grant Act. This was the first major step in the development of agricultural education as we have today. This act allowed for the donation of public lands toward the development of colleges to teach agriculture and the mechanical arts. Congress allowed 30,000 acres of public land to be transferred to each state and territory for each member of the Senate and each member of the House of Representatives based on the results of the 1860 census (Section 1). Monies generated from the sale of these lands were invested in U.S. companies on the stock exchange, or other safe bonds [Section 4(6)]. Revenue generated from the sale of donated lands was set up in a trust or endowment to allow for a perpetual fund to insure the establishment, support, and maintenance of one college per state into

perpetuity. The main purpose was to educate the common man in the fields of agriculture and mechanical arts, along with military tactics, promotion of liberal arts, and practical education of the industrial classes, in the professions and pursuits of life [Section 4 (8)].

Late 1800s, Early 1900s

Rasmussen (1989) stated, "Who were the Americans of the 1850s who soon were to establish a nationwide system of agriculture colleges, a national department of agriculture, and a program for giving federal land to settlers?" In 1850, 11,680,000 farm residents made up 50 percent of the population and 64 percent of the labor force. There were one-and-one-half million farms, averaging 200 acres in size. Farmers were contributing mightily to the growth of the nation, with 80 percent of total exports coming from farms (p. 20). The Hatch Act of 1887 established the funding for agriculture experiment stations at a rate of one station per Land Grant University (Section 1) and allowed for the recognition of research as the major function of land grant universities, which contributed to the development of scientific-based education (Section 2).

As noted by Rasmussen (1989), Congress enacted the Morrill Act of 1890. The Morrill Act sometimes referred to as the second Land Grant Act gave stricter guidelines to how money was to be funneled from the federal government through the states, to land grant universities. The Morrill Act broadened land-grant programs and set up funding for black land-grant schools (p. 24).

Rasmussen (1989) also stated, "As we began the 20th century, a strong movement in the area of agricultural education was started." Most agricultural advances of the 20th century would not have happened if not for the co-development of the extension service

and the land grant universities. This refers back to The Morrill Act which established the land-grant universities. Demonstrations were how experiment stations delivered agricultural programs to the people. Originating from the Boy's and Girls' clubs, these individuals were called demonstration agents, later known as extension agents.

Seaman A. Knapp is known as the father of Extension. He wore many hats, from minister, educator, editor, administrator, farmer, banker, and college president. He strongly promoted the use of demonstration to aid farmers. These demonstrations were used with great success in curbing the boll weevil in Texas. Knapp started with 25 to 30 special agents to assists farmers with demonstrations. By 1904, this number grew to 7,000 special agents. The first known county demonstration agent was W. C. Stallings, hired in Texas in 1906. During the same time period, more demonstration agents were hired with private funds to address topics of interest to homemakers. In 1900, the Corn Club for boys was formed. This later became the 4-H Club; open to both boys and girls (pp. 34-36).

History of 4-H in South Carolina found in Favorite Recipes of South Carolina 4-H Families (1984)

> From 1907 to 1911, the first 4-H Club in Mississippi was formed. The cloverleaf was adopted as a national symbol for 4-H Clubs and the four H's stand for head, heart, hands, and health. The main purpose of the Corn Clubs, later 4-H Clubs, was to teach the youth of America in the skills of leadership and community service. This four-fold teaching aided youth members in developing the leadership skills needed to function in today's society through agricultural projects. Agricultural projects varied through the years. In the beginning, all projects were related to agriculture in the raising of farm animals for boys and home economics for girls (pp. 6-9).

In South Carolina, O. B. Martin was the State Superintendent of Education during the formation of the extension service. He saw opportunities for the youth and with help from Seaman Knapp he provided leadership and guidance for the early Extension concept. Teachers were provided opportunities to participate in youth club training, such as the Corn and Tomato Clubs developed by Martin.

In 1916, Marie Cromer, a teacher in Aiken County, led the way for girls' clubs to be formed in South Carolina. Along with Dora D. Walker, Marie Cromer extended the girls' clubs into women's clubs. Cromer and Walker were hired by Winthrop College to conduct women's and girl's Extension programs. This was all a precursor to what is referred to as general agricultural education, with little formal education in the area of agriculture (pp. 6-9).

Rasmussen (1989) stated further:

> In 1942, 4-H'ers were directly responsible for over 77,000 head of dairy cattle, 246,000 swine, and 210,000 head of other livestock. Field crop production also increased. 4-H contributed over 40,000 tons of forage crops and 109,000 bushels of root crops. In Texas alone, it was estimated that 4-H members produced enough food and fiber to supply 17,000 fighting men (p. 114).

The Smith-Lever Act of 1914 established a mutual cooperation between the United States Department of Agriculture and land grant colleges in the area of conducting agricultural Extension work with specific work to be done. In short, the Act stated that the work:

> . . . shall consist of instruction and practical demonstration in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons information on said subjects through field demonstrations, publications and otherwise . . . (Sixty-third Congress Ch 6,38 Stat 372).

Rasmussen (1989, p. vii) went on to write that Extension's underlying system philosophy was to "help people help themselves" by "taking the university to the people."

Smith-Hughes Act of 1917—Vocational Education

Before Congress enacted the Smith-Hughes Act of 1917, also known as the Smith-Hughes Vocational Education Act of 1917, there were no guidelines or standards for formal teaching of agricultural education. The primary function of the Smith-Hughes Act was to promote vocational agriculture, to train the public to work on the farm, and to provide funding to insure completion. Under the act, each state was to establish a State Board for Vocational Education to insure that the federal funding was managed properly and to insure that the common man was educated in the area of agriculture (Section 8). This was the beginning of formal agricultural education.

At the state level, the curriculum was to be developed for the training of vocational agriculture and the standards or guidelines developed for the training of vocational agriculture teachers. Upon completion of the curriculum, the state is then required to summit the curriculum, along with expenditures of money and receipts under the act, to the Federal Board of Vocational Education for approval. Each state operated the vocational education system under strict guidelines from the federal government. To insure the funds only went to vocational education, Congress stipulated that teachers had to have vocational experience in order to use funds from the Smith-Hughes Act. This protected the funds from being used by other areas of the schools. As a result, vocational education was removed from the mainstream of school operations (Section 12).

The act also required that schools or classes for students (students defined as any-one not employed or having employment) devote half of class time to the practical or productive aspect of agriculture (Section12). If a high school student was taught by a teacher funded or paid in full or in part by federal vocational funds, the student could re-ceive no more than 50 percent academic instruction. This allowed the Federal Vocational Board to extend complete control over the student's time. As a result, the 50-25-25 rule was adopted. This rule was defined as 50 percent of the student's time in shop work, 25 percent in closely related subjects, and 25 percent in academic course work. This rule was adopted as the universal guideline of state plans from the 1920s to the early 1960s. This rule fit the needs of the country for this period of time. Although this ratio was not a perfect fit, the law and rule were needed to protect vocational teaching from the scowl of the educational elite (Section 12).

In 1928, the Future Farmers of America organization was founded. The mission statement of the Future Farmers of America states: "FFA makes a positive difference in the lives of students by developing their potential for premier leadership, personal growth, and career success through agricultural education" (ffa.org). With the emergence of formal agricultural education, a mission statement was developed for agricultural education. The mission of agriculture education is to prepare and support individuals for careers in, build awareness of, and develop leadership for the food, fiber and natural resources systems (ffa.org). The development of the FFA and 4-H youth groups allowed for youth development in the fields of agriculture preparing youths for careers in agriculture.

"Once Sputnik went up, the conversation changed around the dinner table" (retrieved September 08, 2008: reported by Greg Toppo, USA Today). It is tempting to believe that before Sputnik the math and science education system in the United States was moribund, but historians disagree. U.S. scientists and engineers had helped win World War II, after all, and plans for better coursework already were in place in 1957. But they got a much-needed push. At the time, many Americans feared that federal funding could lead to federal control. But in 1957, educators quickly seized on the launch and pushed for more government money. "They saw Sputnik as an opportunity to bang the drum" says New York University education historian Diane Ravitich. It also settled the question of "whether the federal government should be involved in education at all."

In 1958, Congress approved $1 billion for the National Defense Education Act, or NDEA, the first of an alphabet soup of more than a dozen programs meant to help U. S. students, handpicking them for upper-level courses. In addition, Senator Lyndon Johnson held the first hearings on spending for school construction. That summer, schools began receiving matching funds, not only for math and science but also for foreign languages.

The focus of schools on gifted students was short-lived. It was replaced in the 1960s by a move toward equal education for all. What survived was the commitment by Congress to help pay for education. In 1964, President Johnson signed the landmark Elementary and Secondary Education Act, which today lives on as No Child Left Behind. (http://www.usatoday. com/news/education/2007-10-03-sputnik-education_N.htm).

Expansion of Extension Work

The Extension Service added urban programs for low-income families, minorities and migrant workers. Agriculture programs offered were integrated pest management, energy, pesticide applications, farm safety, and 4-H added programs in urban areas. Urban gardening was one of the most effective programs and received a $1.5 million federal grant in 1977. The 1980s and 1990s observed another shift in the mission of Extension as the mission was amended to include more management, coping with stress, and less on production. Home economists shifted their focus from the needs of a stay at home working mother to a career woman. Due to major changes in the family structure, adjustments were made in how extension programs were designed and developed to meet the needs of today's homemaker

Two alternative crop production programs were developed in the last 20 years of the 20th century, aquaculture and pick-your-own. Aquaculture started out as farm-raised catfish, and expanded into other aquatic species. Pick-your-own saved on labor, since customers picked their own product. The big buzz today is sustainable agriculture and biotechnology.

Another major improvement of the late 20th century was information technology. The use of computers, interactive videos, distance learning over satellite, and the World Wide Web has made the Extension service and agricultural education communication easier. Information can move a lot quicker to the consumer and then can be followed up with a one-on-one visit from a local Extension agent (www.clemson.edu/ staff development/knowledge/ history_Ext.ppt).

No Child Left Behind (NCLB) Act of 2001

Hewitt (2006) stated:

> Concerning schools and schooling, there are two familiar contemporary examples. The report of the National Commission on excellence in Education of 1983, *A Nation at Risk,* initiated a national school reform movement that took different forms depending on how political parties and interest groups coalesced on particular aspects of the report. The legacy of that report, the impetus to and emphasis on reform continues today. The importance of the report was not its effect on direct policy making but promoting different approaches to reform rather than using the governing apparatus of the state and the law. That changed with the most recent reform initiative, the No Child Left Behind (NCLB) Act of 2001, signed into law in 2002. This act is the latest reincarnation of the Elementary and Secondary Education Act dating from the 1960s. The NCLB Act is a comprehensive accountability program based on extensive testing and increased financial support for schools keyed to meeting particular mandates such as developing curriculum standards, establishing comparative student performance levels across states, and assuring teacher quality in the areas of curriculum expertise. Reform, standards, associated coats, and the NCLB Act are major educational policy issues with important curriculum implications. The importance is the shift from policy initiatives resulting from reports and reformers to direct policy making by law (pp. 54-55).

NCLB and Accountability

According to Hewitt, (2006) the latest chapter in accountability is the NCLB Act of 2001 and what it entails. This federal legislation is one of a series of acts since the landmark mid-60s Elementary and Secondary Assistance Act that expanded federal involvement in American schooling. The effects of the NCLB are pervasive and, as noted earlier in the chapter, are entwined in most aspects of schooling, curriculum, and instruction. The many provisions of the Act fall essentially into two main groups: those about creating standards and designing assessments, and those addressing teacher qualifications and teaching. These provisions include:

Standards and Assessments:

- establish reading standards,
- establish mathematics standards,
- implement annual assessment in reading and language arts,
- implement annual assessment in mathematics.

Teaching and the Teacher:

- define a highly qualified teacher,
- establish indicators for subject-matter competence,
- develop tests for new elementary teachers,
- ensure highly qualified teachers are in every classroom,
- ensure high-quality professional development,
- use teaching tools based on scientific research.

The NCLB requirements are for states and public schooling. Note the references to curriculum in mathematics, reading, and language arts. Along with science, those content areas of the curriculum have become the focus because the testing that is done emphasize student performance in those areas. This raises potential curriculum issues about the purpose, scope, and balance in curriculum (p. 364).

As with any new law, implementation brings scrutiny, especially when the requirements "mandate" adherence to the time lines into 2006 and beyond. Of course, as with any new law as significant as NCLB, controversies will arise as experiences with the law provide anecdotal evidence of its relevance in establishing accountability and renewal in public schooling. These controversies engage political partisans, academic

and school experts, teachers, and assorted organizations and interest groups. Their opinions, however, are not based on any hard evidence external to the law or based on ongoing research under the law. The contentions are too numerous to mention and deserve your fresh exploration in emerging literature. What can be discerned is that there are a series of discussion points including:

1. The costs of implementation for the states, the adequacy of federal funding, and whether funds for testing are taking funds from other resources needed for schools.
2. The lack of accountability and standardization of standards across the states.
3. Balance in the curriculum for all students and subject areas, and the promotion of mathematics, science, reading, and language arts over other curriculum areas.
4. The meaning of scientific research and what exactly is educational practice guided by good, rigorous science.
5. The requirements for high-quality teachers and placement in subject-matter assignments--how and by whom requirements and placement are determined and how standardization in the preparation across 50 different state requirements can be achieved.
6. The intent of the law and the appropriate federal role-that the law is too complex, and that the time lines for implementation and results are unreasonable.

The NCLB law is the lightning rod for conflicts about the federal and individual state roles in society. Present and future discussions about it raise very important questions about the American federal system, the separation and distribution of constitutional power and intuitions, and the nature of civic culture in American society (pp. 363-365).

Meat Science

Aberle (2001) defined meat science as:

Meat Science is not limited to the study of tissues. It is a component of all facets of the meat industry, beginning with animal production and ending with final preparation of meat for consumption. Animal breeding, feeding, and management are extremely important parts of the food chain because meat quality actually starts on the farm or ranch or in the feed lot.

Meat Science encompasses the activities of packers, processors, and purveyors, or that segment of the industry that coverts live animals into food products and then distributes such products to merchandisers. Meat technology is applied to maintain product quality and wholesomeness and to develop new and different products.

Retail meat markets, hotels, restaurants, and institutions are important components of the marketing system. Retailers and food service operations are the meat industry's representatives to consumers. Meat retailers prepare many fresh meat cuts, display all meat products in an attractive manner, and maintain product quality and wholesomeness. The hotel, restaurant, and institutional management group carries meat processing to its ultimate end, and places cooked meat before the consumer. The final cooking and serving of meat is just as important as any segment of the complex industry that brings meat from grazing lands, feedlots, and housing units to consumers.

One reason for the increasing complexity of livestock and meat business is that new competitive food products are being developed continually. These new competitors seek to entice consumers with modifications in convenience, price, quality, uniformity, nutritional value, or even with novelty. If the meat industry is to maintain its present position of importance in the food production chain and maintain a dynamic and growing market, it must produce the highest quality products with the greatest efficiency, develop innovative new products, and employ sophisticated advertising and promotion programs. Such developments require the input of students trained in meat science.

Students who plan to be associated with the meat industry during their working careers must not be satisfied with learning only the status of the industry today, for this knowledge will soon be out of date. Instead they

must learn basic concepts and be prepared to apply these to changing situations. Indeed, they should be prepare to initiate change.

Meat processing and preservation are described as the principles from which processes have been developed to prepare and preserve hundreds of different meat products. Many other topics, such as inspection, food safety, grading and standardization, and by-products are included, providing an in-depth coverage of many aspects of the total meat industry (pp. 2-3).

Food Science

Potter and Hotchkiss (1995) defined food science as:

Food science can be defined as the application of the basic sciences and engineering to study the fundamental physical, chemical, and biochemical nature of foods and the principles of food processing. Food technology is the use of the information generated by food science in the selection, preservation, processing, packaging, and distribution, as it affects the consumption of safe, nutritious, and wholesome food. As such, food science is a broad discipline which contains within it many specializations such as food microbiology, food engineering, and food chemistry. Because food interacts directly with people, some food scientists are also interested in the psychology of food choice. These individuals work with the sensory properties of foods. Food engineers deal with the conversion of raw agricultural products such as wheat into more finished food products such as flour or baked goods. Food processing contains many of the same elements as chemical and mechanical engineering. Virtually all foods are derived from living cells. Thus, foods are for the most part composed of "edible biochemicals," and so biochemists often work with foods to understand how processing or storage might chemically affect foods and their biochemistry. Likewise, nutritionists are involved in food manufacturing to ensure that foods maintain their expected nutritional content. Other food scientists work for the government in order to ensure that the foods we buy are safe, wholesome, and honestly represented (Potter & Hotchkiss, 1995, p. 1).

Inspection

Romans et al. (2001) noted that the wholesomeness of the meat and poultry industry in the United States is protected by the U.S Department of Agriculture. Federal meat

inspection dates back to June 30, 1906, with the passage of the Meat Inspection Act. Previous to that time, a limited form of federal inspection began in 1891, but this was only a voluntary inspection of cattle and hogs that were intended for export. Upton Sinclair's book, *The Jungle,* has been credited with providing the impetus for the passage of the Meat Inspection Act of 1906. The act has been validated continually and improved over the years. One major addition was the passage of the Wholesome Meat Act on December 15, 1967. The major thrust of the 1967 law was to make all of the various state inspection systems at least equal to the federal inspection system. Previous to this time, federal meat inspection applied only to meat and meat products in interstate or foreign commerce. Many states had their own inspection systems for the meat and meat products moving within their own state borders, but others did not. Thus, consumers in the different states had varying levels of protection.

On October 26, 1986, Congress passed Public Law 99-641, the Commodity Futures Act, which amended the Federal Meat Inspection Act to permit the U.S. Department of Agriculture to vary the intensity of inspection among plants. The passage of this act was based on the success of a Voluntary Total Quality Control Program that had been in effect since 1980, which gave processors incentives to develop and monitor their own quality control systems, provided they met government inspection requirements. This program is called Discretionary Inspection (DI) and (or) Improved Processing Inspection (IPI) and is designed to put the greatest financial and human inspection input where the risk is the greatest.

On July 25, 1996, the final regulation titled Pathogen Reduction: Hazard Analysis and Critical Control Point (HACCP) Systems, known throughout the meat industry as the "Mega Reg," was published in *The Federal Register* (Volume 61, Number 144). The purpose of this final regulation was to move meat inspection from command-and-control regulations to a science-based system. This development was suggested and supported by the National Academy of Sciences, the U.S. General Accounting Office, and inspection personnel (Romans et al., 2001, pp. 37-38).

Curriculum Development

Definition

Before curriculum development can be defined, we need to define curriculum. Pratt (1980, p. 4) defined curriculum as: "A curriculum is an organized set of formal educational and/or training intentions." Pratt (1980) went on to state that this definition needed further explicit explanation which included;

1. A curriculum is intentions, or plans, whether written down or mental, but generally written.
2. A curriculum is not activities but plans, or a blue print, for activities. Program is also referred to as learner activities in the implementation of a curriculum.
3. A curriculum contains many other kinds of intentions, learning students are to develop, evaluation for assessment, criteria for acceptance in program, equipment and materials needed, and teacher qualifications.
4. Curriculum involves organized planned learning activities not random unplanned nonbearing activities.

5. An organized set of intentions, a curriculum articulates the relationship among its different elements (objectives, content, evaluation, etc.) integrating them into a unified and coherent whole. In a word, a curriculum is a system.

6. Both education and training are referred to in the definition to avoid the misunderstanding that occurs if one is omitted (p. 4).

Lewis and Miel (1972, p. 27), identified definitions of curriculum in the following categories: course of study, intended learning outcomes, intended opportunities for engagements, and learner's actual experiences. They defined curriculum as "a set of intentions about opportunities for engagement of person-to-be-educated with other persons and with things (all bearers of information, processes, techniques, and values) in certain arrangements of time and space,"

Bobbitt defined curriculum at the turn of the 19th century as: ". . . that series of things which children and youth must do and experience by way of developing abilities to do the things well that make up the affairs of adult life; and to be in all respects what adults should be" (Bobbitt, 1918, p. 42).

Finch and Crunkilton (1999, p. 11) defined curriculum as "the sum of the learning activities and experiences that a student has under the auspices or direction of the school" Hewitt (2006) also defined curriculum development

> as one kind of curriculum work that refers to the creating of curriculum and also refers to the adoption and adaptation activities when implementing curriculum. It can range from the informality of the classroom teacher's handwritten paragraph for learners to the formal commercial venture creating a set of curriculum materials" (Hewitt, 2006, p. 407).

Hewitt reported that: "Curriculum adoption is to take a curriculum as it has been produced and implement it without change" (Hewitt, 2006, p. 406). Curriculum adaptation

means to take curriculum as it exists and change it either before, during or after implementation to adjust or adapt it to fit the circumstances (Hewitt, 2006, p. 406).

Definition of Career and Technological Educational Curriculum

Before we can address the definition of career and technology education curriculum, we first must define the foundation of career and technology and that is vocational education. Combs defined vocational education as:

> A program of education, below the college level, under public supervision and control or under contract with a state or local education agency and organized to prepare the learner for entrance into a particular chosen occupation or to upgrade employed workers. Vocational education includes such divisions as vocational agriculture, business education, marketing education, health occupations education, home economics education, and trade and industrial education (as cited in Flanders, 1988, p. 14).

Originally, vocational education curriculum dealt with the education of the whole person. Conner and Ellena defined vocational education as "a series of organized experiences designed by educators to prepare students for employment" (Conner & Ellena, 1967, p. 291). Additional definition by McNeil noted: "Total effort of school and community to help all persons become familiar with the values of a work-oriented society" (McNeil, 1977, p. 223). Barlow (1973, p. 27) stated vocational education "makes provisions for wide differences among individuals; it assumes democracy is concerned with every occupation, and is deeply dedicated toward the development of literate and educated man."

After understanding vocational education, we can now address the definition of career and technology education. Scott and Sarkees-Wircenski (2001, pp. 2-3) defined career and technical education as:

> . . . A large and diverse educational enterprise spanning both secondary and post secondary education. It encompasses a tremendous number of programs designed to prepare for employment and for living. Most people identify career and technical education at the secondary level with courses in one of the seven specific labor market program areas: agriculture, business, family and consumer science (formerly home economics), marketing (formerly distributive education), health, trade and industry (T&I), and technical/commutations. Technology education (formerly industrial arts) is sometimes viewed to be the service area of career and technical education, but it is more appropriately viewed as a vital part of general and academic education. The most popular career and technical education courses are Business and T&I, with business enrolling over one-half of all students and T&I enrolling one-third. Enrollment in the other service areas is roughly equal. Examples of courses taught in the service area include agriculture science, carpentry, accounting, word processing, retailing, fashion, practical nursing, respiratory therapy, child care, electronics, computer programming, and food and nutrition (Scott and Sarkees-Wircenski, 2001, pp. 2-3).

History of Curriculum

Tanner and Tanner (1980, p. 36) traced the history of curriculum definitions and demonstrated that curriculum has been variously defined as:

1. the cumulative tradition of organized knowledge.
2. modes of thought;
3. race experience;
4. guided experience;
5. a planned learning environment;
6. cognitive/ affective content and process;
7. an instructional plan;

8. instructional ends or outcomes; and

9. a technological system of production.

Herring and Norris concluded:

Teachers of vocational agriculture have traditionally been expected to instruct students in a variety of areas. However, these areas often have been production oriented, designed to prepare students to return the farm or ranch. In recent years, courses have been added to the curricula that have provided meaningful experiences for students in non-traditional areas in agriculture sciences such as horticulture and agribusiness. This trend away from traditional production agriculture must continue to be the way of the future if vocational agriculture is to survive in the secondary schools systems across this nation. These changes should not be looked upon as threatening, but as challenging opportunities to reshape the program of vocational agriculture to meet the needs of the students of tomorrow (AGED, 1987, 60(4), p. 19).

A profession grows or it dies; it changes or it faces atrophy, stagnation, and slow demise. These clearly cannot be viable options. The profession must become the hotbed of experimentation in education, not the guardians of the tombs of a bygone success. The challenge is clear. What will we do with it? (AGED, 1987, 60(4), pp. 19-20).

Debertin and Williamson (1987) reported:

If vocational agriculture is to survive and prosper under the current conditions facing agriculture, the objectives under which the program is conducted and marketed must be expanded and broadened. Increased emphasis will need to be placed on the development of skills that, while perhaps useful employment, are not necessarily identified as purely vocational rather than college preparatory, nor necessarily purely agricultural in orientation. One of the reasons educators in vocational agriculture have not always promoted the success of many of the broad-based, nonvocational aspects of the program has been because of the mandate for vocational training in agriculture outlined in the original Smith-Hughes legislation for vocational agriculture written in the early 1900s. U.S. agriculture has undergone enormous change since the original legislation was written (AGED, 1987, 60(4), pp. 22-23).

On October 19, 1984, President Reagan signed into law the Carl D. Perkins Vocational Education Act, which would have an effect on the management of agricultural education programs for the next five years. In 1985, Case noted:

> In order to manage vocational agriculture programs effectively and make the best use of available federal funds, agriculture leaders will need to:
>
> 1. begin by developing a program plan that meets the needs of local students and the community;
> 2. familiarize themselves with the Carl D. Perkins Vocational Education Act;
> 3. understand program areas of the Act which could apply to agriculture education, and
> 4. understand the process the state must use to comply with the law and make proper use of federal funds (1985, p. 7).

Case further clarified that the act emphasizes "Program Opportunities" (Title II, Part A) and that funds are to be spent on forward-looking projects for innovation, improvement, development, and modernization of programs, rather than for maintenance (1985, p. 7).

Federally funded agriculture programs under Title II; Part A should address the needs of:

1. the handicapped and disadvantaged,
2. adults needing training and retraining,
3. single parents and homemakers,
4. those participating in programs that help eliminate sex bias and stereotyping,
5. criminal offenders.

Regarding these groups, methodology used in agriculture education programs would serve the handicapped and disadvantaged populations well (Case, 1985, p. 7). In

summary, the strategy for agriculture leaders is the proper way to use federal funds in their programs and influence vocational education development following state priorities. These state priorities include:

1. understanding the needs of the local community;
2. becoming involved with the state plan development and approval process;
3. providing information for, and consulting with, state plan decision-makers;
4. understanding the national priorities as stated in the Carl D. Perkins Vocational Act of 1984.

Though the act provides a listing of national priorities, it provides states with the flexibility on how they will meet the needs of individuals in the vocational education programs (Case, 1985, p. 8).

Herring (1995, p. 22) summarized managing change in agricultural education into several major points:

1. Change is inevitable.
2. We face great challenges in agriculture education as we attempt to respond to change.
3. We must respond to change in a positive manner by:
    a. learning to manage the future,
    b. being attackers rather than defenders,
    c. shifting our paradigms,
    d. having a vision for the future,
    e. practicing synergism, and
    f. sharpening the saw.

Herring (1995, p. 22) noted:

> We know from studying the change process that the greatest single inhibitor to change is satisfaction with the status quo. It has been said that the greatest enemy of the best is the good. We can be content with "good" programs and miss the best that students deserve. Not only that, we will miss the best that we deserve.

Torres and Dormody stated:

> The 1990 Carl D. Perkins Vocational and Applied Technology Act provides federal dollars for improving vocational education programs by integrating both academic and occupational skills that students will need to work in a technologically advanced society (Torres and Dormody, 1995, p. 15).

The Carl D. Perkins Act of 1990, allowed for a more flexible curriculum with more cooperation between groups, especially more integration of academics and vocational education (Finch & Crunkilton, 1999, p. 8).

Hewitt, (2006, p. 88) noted:

> curriculum development can occur in a variety of places, it is a process, it results in both a product that is the curriculum and in materials that represent the curriculum, and it is an activity carried on by both school and nonschool participants. Curriculum development is not some difficult technical pursuit such as trying to understand and work with nanotechnology or grasping what string theory is all about. Curriculum development work is very practical, requiring a basic understanding of certain elements that are involved in working with it. Curriculum workers, when developing curriculum, need to know certain conceptual fundamentals and initial ideas before engaging in that curriculum work. For example, curriculum can't truly be discussed without considering scope, sequence, continuity, and balance, which can be collectively referred to as curriculum fundamentals. Similarly, you will find that scale and capacity are important considerations in other curriculum work such as policy making and planning, as well as curriculum development.

The Future of Curriculum Standards

Hewitt (2006, p. 417) defined standards-based education:

> Standards-based education is the development of educational practices based on (a) clearly stated and measurable description of what students are to know and do as a result of schooling, (b) a curriculum allowing students to meet those descriptions, and (c) assessments developed to validate student achievement or attainment levels.

Finch and Crunkilton (1999) stated:

> Standards must be established that will provide a frame work for quality vocational programs. Although the number of standards may vary with the different vocational programs, there are several common standards that should be established regardless of the vocational area. General categories of standards are:
>
> 1. prospective enrollment,
> 2. availability of qualified instructors,
> 3. available facilities,
> 4. available equipment,
> 5. available funding,
> 6. employment opportunities,
> 7. availability of other similar vocational programs,
> 8. extent to which the vocational programs under consideration support the goals and philosophy of the school,
> 9. extent to which delivery of the program uphold established guidelines,
> 10. opportunities for cooperative vocational education programs (p. 66).

For example, if a course in word processing were under consideration, a standard referring to equipment might be "15 computers must be available." Detailed standards that

focus directly on program quality greatly assist decision makers in arriving at sound decisions concerning curriculum development.

Hewitt (2006, p. 185) noted that the movement of authority and responsibility from local districts to state and federal levels is one important change. The development of standards is another. Whereas the current emphasis is on states developing their own standards, this will not, as Squires (2004) pointed out, create the necessary alignment for national comparisons because there is no single set of standards that gives a measure of common equivalency.

Delphi Technique

History and Uses of the Delphi Technique

The Delphi Technique was developed in the 1950s by two research scientists working for the Rand Corporation—Olaf Helmer and Norman Dalkey. They developed the survey procedure as a tool for forecasting future events using a series of intensive questionnaires interspersed with controlled feedback (Dalkey & Helmer, 1993; McCampbell & Stewart, 1992; Weaver, 1971). Participants were solicited experts in the issues related to national defense such as forecasting probable bombing targets the Russian government might choose in the event of an attack on the United States (Dalkey & Helmer, 1963; Custer, Scarcella, & Stewart, 1999; Finch & Crunkilton, 1999). "The Delphi Technique has been found to be a most useful tool in setting priorities, establishing goals, and forecasting the future. Obviously, this technique would be of much value when persons desire consensus regarding the content of a particular curriculum" (p. 159).

Casey reported that "The Delphi Technique was originally conceived as a way to obtain the opinion of experts without necessarily bringing them together face to face (doncasey.home.mindspring.com/bb-5.htm, p. 1)."

There are three steps to diffusing the Delphi Technique when facilitators want to steer a group in a specific direction (Stutter, retrieved 28 August 2008):

1. Always be charming, smile, be pleasant, be courteous, moderate your voice so as not to come across as belligerent, or aggressive.

2. Stay focused. If at all possible, write your question down to help you to stay focused. Facilitators, when asked questions they don't want to answer, often digress from the question raised and try to work the conversation around to where they can make the individual asking the question look foolish, appear belligerent of aggressive. The goal is to put the one asking the question on the defensive. Do not fall for this tactic, always be charming, thus deflecting any insinuation, innuendo, etc. that may be thrown at you in their attempt to put you on the defensive, bring them back to the question you asked. If they rephrase your question into an accusatory statement (a favorite tactic) simply state, "that is not what I stated. What I asked was . . . [repeat your question]." Stay focused on your question

3. Be persistent. If putting you on the defensive doesn't work, facilitators often resort to a long, drawn out dissertation on some off-the-wall and usually unrelated or vaguely related subject that drags on for several minutes. During that time, the crowd or group usually loses focus on the question asked (which is the intent). Let them finish with their dissertation or exposé. Then nicely, with focus and persistence, state, "but you didn't answer my question. My question is . . . [repeat your question]" (http://www.seanet.com/~barkonwd/school/DELPHI.HTM, pp. 1-2)

Linstone and Turnoff (1975) reported, "Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem." Custer, Scarcella, and Stewart, stated:

> The Delphi is an open-ended questionnaire that is given to a panel of selected experts to solicit specific information about a subject or content area. In subsequent rounds of the procedure, participants rate the relative importance of individual items and also make changes to the phrasing or substance of the item. Through a series of rounds (typically three) the process is designed to yield consensus" (JVET, 1999, 15(2), p. 51).

Criteria for Effective Use of the Delphi Technique

Linstone and Turnoff (1975, p. 4) listed several properties to follow as to when to employ the Delphi Technique:

1. The problem does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis.

2. The individuals needed to contribute to the examination of a board or complex problem have no history of adequate communication and may represent diverse background with respect to experience or expertise.

3. More individuals are needed than can effectively interact in a face to face exchange.

4. Time and cost make frequent group meetings infeasible.

5. The efficiency of face to face meetings can be increased by a supplemental group communication process.

6. Disagreements among individual are so severe or politically unpalatable that the communication process must be refereed and / or anonymity assured.

7. The heterogeneity of the participants must be preserved to assure validity of the results, i.e., avoidance of domination by quantity or by strength of personality ("bandwagon effect").

Advantages of the Delphi Technique

Generally speaking the Delphi has three features: anonymity, controlled feedback, and statistical group response. Anonymity, affected by the use of questionnaires or other formal communication channels, such as on-line computer communications, is a

way of reducing the effect of dominant individuals. Controlled feedback—conducting the exercise in a sequence of rounds between which a summary of the results of the previous round are communicated to the participants—is a device for reducing noise. Use of a statistical definition of the group response is a way of reducing group pressure for conformity. At the end of the exercise, there may still be significant spread in individual opinions. Probably more important, the statistical group response is a device to assure that the opinion of every member of the group is represented in the final response. Within these three basic features, it is, of course, possible to have many variations (Dalkey, 1972, pp. 20-21).

> One distinct advantage of the Delphi Method is that the experts never need to be brought together physically, and indeed could reside anywhere in the world. The process also does not require complete agreement by all panelists, since the majority opinion is represented by the median. Since the responses are anonymous, the pitfalls of ego, domineering personalities and the "bandwagon or halo effect" in responses are all avoided (retrieved 3/5/2006 from The Delphi Method) (http://www.ryerson.ca/~/mjoppe/ResearchProcess/841TheDelphiMethod.html).

Criticisms of the Delphi Technique

Linstone and Tuner (1975, p. 6) listed some common reasons for the failure of a Delphi:

1. Imposing monitor views and preconceptions of a problem upon the respondent group by over specifying the structure of the Delphi and not allowing for the contribution of other perspectives related to the problem.

2. Assuming that Delphi can be a surrogate for all other human communications in a given situation.

3. Poor techniques of summarizing and presenting the group response and ensuring common interpretations of the evaluation scales utilized in the exercise.

4. Ignoring and not exploring disagreements, so that discouraged dissenters drop out and an artificial consensus is generated.

5. Understanding the demanding nature of a Delphi and the fact the respondents should be recognized as consultants and properly compensated for their time if the Delphi is not an integral part of their job function.

Custer, Scarcella, and Stewart (1999) noted:

> One significant problem that is often encountered in Delphi studies has to do with the rigors involved in maintaining focus when rating competency sets containing large numbers of items. Beyond problems with maintaining sufficient levels of concentration, large competency sets can consume large blocks of time and thus represents common source of panel attrition. Many Delphi studies contain as many 50 items; however, some studies contain considerably more than that amount (p. 52).

The Modified Delphi Technique

A modified Delphi Technique was used in this study. Custer, Scarcella, and Stewart (1999) noted:

> The modified Delphi Technique is similar to the full Delphi in terms of procedure (i.e., a series of rounds with selected experts) and intent (i.e., to predict future events and to arrive at consensus). The major modification consists of beginning the process with a set of carefully selected items. These pre-selected items may be drawn from various sources including related competency profiles, synthesized reviews of the literature, and interviews with selected content experts. (JVET, 1999, 15(2), p. 51).

Survey Method

Schonlau et al. (2002) reported:

> The Internet has introduced innovations that have spawned new methods for conducting surveys, most notably surveys done via electronic mail (e-mail) and the World Wide Web. In e-mail surveys, the survey instrument

> is contained in the body of the e-mail message or in an e-mail attachment. In many cases, the respondent can complete the survey by simply replying to the original e-mail. Web surveys are "hosted" (that is, they reside) on a Web site. The respondent visits the survey Web site by either clicking a hyperlink in an e-mail or in another Web site, or by typing the Web address directly into the address box in the browser window.

Internet surveys have been both hyped for their capabilities and criticized for their limitations. To put Web and e-mail surveying in perspective, it is instructive to examine what was written about telephones and mail surveys when they were still regarded as unproven survey methodologists (pp. 1-2).

> Internet surveys are currently in vogue largely because of four popular assumptions about how they stack up against more-traditional survey mediums: (1) they are less time consuming; (2) they are just as good or better then more-traditional surveys; (3) they are much cheaper to conduct; and (4) they are easier to execute. However, these assumptions may or may not be true depending on the individual circumstances of the survey. Furthermore, with the hype surrounding the Web in recent years, researchers sometimes base their decision on whether or not to conduct Web surveys on something other than substantive information. Therefore, researchers need to recognize the current limitations of Internet surveys (pp. 2-3).

Dillman stated:

> In 1981, an assessment by the United States Office of Management and Budget, which approved all surveys sponsored by the federal government, revealed that 69% were conducted solely by mail, and another 11% were conducted partly by mail (U.S. Office of Management and Budget, 1984). The reason for this preference undoubtedly involved lower cost and the fact that organizations could conduct such surveys themselves, whereas most interview surveys, whether by telephone or face-to-face, needed to be contracted to professional organizations.
>
> Nonetheless, there can be little doubt that the dominant method for conducting large-scale, nationally prominent, general public surveys was face-to-face interviewing prior to the 1970s, and since then telephone methods. The speed and efficiency of telephone surveys was demonstrated dramatically and with much visibility by overnight surveys during the Watergate hearings in 1974. The fact that the telephone was a fixture in virtually all

businesses and most homes contributed to its becoming the standard survey method for the United States in the 1980s and 1990s. The telephone was also the first survey method to benefit fully from computerized survey methods, especially computer-assisted telephone interviewing (CATI) software which eliminated keypunching. Automatic call-scheduling, dialing of random digit telephone numbers, and data compilation also contributed to the efficiency of the telephone method.

Self-administrated questionnaires are now poised to benefit enormously from information age technologies. While U.S. Postal Service delivery and retrieval of paper questionnaires remains essential for some surveys, the possibilities for electronic delivery are increasing rapidly. In addition, the elimination of laborious keypunching is within sight, the result of developments in optical scanning and imaging that result in no loss of data quality. Many activities that once required people to interact with another person are now being shifted to self-administration mode.

A ringing telephone no longer elicits an automatic answer from anyone who hears it. The telephone has evolved from being a controller of human behavior that demanded a response to becoming controlled, so that individuals decide who can reach them and when.

New methods of self-administering surveys are also gaining rapid acceptance. E-mail, web, and touch-tone data entry (or interactive voice response) methods have become feasible, and their use is growing rapidly. For all these reasons, the use of self-administered questionnaires will become more important both individually and as a component of mixed-mode data collection systems as we enter the twenty-first century (pp. 7-8).

Web surveys contrast in many ways with current e-mail surveys. Instead of the Web questionnaire being sent with e-mail message, it is constructed on a web site for which the respondent must have a different software application to access it. Questions are constructed in a fixed format with the goal of making the questionnaire appear the same for all respondents, this goal may not always be achieved. There are different programming languages and styles that one can use for building a Web questionnaire, some of which are quite sophisticated. Questionnaires can be constructed screen-by-screen so that each time an answer is provided the respondent goes to a new question in a new screen. Alternatively, they can be constructed so respondents can use the scroll bar at the side of the screen to go anywhere to the questionnaire at anytime. Pop-up boxes can be inserted that, when clicked on, can provide special instructions at the point they are needed in a survey. Similarly, drop-down boxes can be added that hide

response options from view until they are needed. A sense of progress can be provided in an effort to avoid people quitting when they are only a few questions from the end (pp. 372-373).

CHAPTER III

METHODOLOGY

Problem Statement

In today's world, concern with food safety is an everyday issue and occurrence. Thus, development and evaluation of basic meat science curriculum standards at the secondary agricultural school level is essential. Consideration of sanitation, preparation, carcass handling, meat processing, meat fabrication (cutting), and carcass harvesting is essential and needs to be validated in a basic meat science curriculum.

Purpose and Objectives

The purpose of this research is to develop a list of meat science topics and standards for a basic meat science curriculum in secondary agricultural education using an Expert and Delphi Panels and agricultural education teachers. The Delphi panel participants were selected from industry and academia. Teachers' representatives were current agricultural education teachers from six southern and mid-Atlantic states—Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

The following objectives will be established in conducting this research:

1. develop basic meat science topics for a basic meat science curriculum at the secondary agricultural education school level,
2. develop a list of standards under each topic to validate a basic meat science curriculum at the secondary agricultural school level and,
3. have standards validated by current agricultural education teachers who teach animal science and/or animal production courses.

Instrumentation

This study used an expert panel to develop a list of basic meat science topics. Experts were selected for this study based on meeting the criteria of:

1. teaching meat science courses at the college level,
2. coaching meat/livestock judging teams, and
3. participating on a collegiate meats/livestock judging team.

The following people were selected and agreed to serve on the expert panel. The Expert panel consisted of Dr. George Skelley, Professor Emeritus Meat Science, Animal and Veterinary Sciences, Clemson University, Dr. Melvin Hunt, meat science faculty at Kansas State University assisted by other meat science faculty at Kansas State University (Appendix V). The expert panel combined basic meat science course syllabi from introductory meat science courses from the following land grant universities: Auburn University, The University of Arkansas, Clemson University, The University of Florida, The University of Georgia, Kansas State University, University of Minnesota, Montana State University, The Ohio State University, Oklahoma State University, Oregon State University, South Dakota State University, The University of Tennessee, Texas A&M University, West Virginia University, and The University of Wyoming into a general outline of basic meat science topics (Appendix A). The syllabi were obtained from university Web sites or personal contacts. The expert panel developed basic meat science curriculum topics.

A validation panel made up of Drs. Thomas R. Dobbins, Donnie R. King, Phillip M. Fravel, and K. Dale Layfield, agricultural education faculty at Clemson University was formed to validate the different aspects of the study.

A Delphi panel was used to develop basic meat science standards under each topics. The standards were validated by secondary school agricultural education teachers. The teachers were asked to rate 100 basic meat science curriculum standards based on a range from "Not a Priority" to "High Priority" (Appendix P).

A modified Delphi research technique was used in this study to develop a list of basic meat science curriculum standards for each topic for secondary agricultural education. Delphi is a proven method used to bring many opinions to a consensus. Custer, Scarcella, and Stewart (1999) noted:

> The modified Delphi Technique is similar to the full Delphi in terms of procedure (i.e., a series of rounds with selected experts) and intent (i.e., to predict future events and to arrive at consensus). The major modification consists of beginning the process with a set of carefully selected items. These pre-selected items may be drawn from various sources including related competency profiles, synthesized reviews of the literature, and interviews with selected content experts. (JVET, 1999, 15(2), p. 2).

Two rounds were used to develop the basic meat science curriculum topics with standards for each topic. Upon the completion of Round 2, the Delphi panel established the survey of standards for a basic meat science curriculum in secondary agricultural education. Using a Web-based survey the standards were ranked on a four-point Likert-type scale—Not a Priority, Low Priority, Moderate Priority, and High Priority. Prior to final analysis of the data, the Likert-type scale was coded to numbers: 1 = Not a Priority, 2 = Low Priority, 3 = Moderate Priority, and 4 = High Priority.

Population

Delphi Panel

Guidelines on the specific number of experts required on a Delphi panel are not available. In a study by Sutphin (1981), seven experts were used, while other studies have used up to 100 experts. The type of study and the expense of having a large number of experts will determine the number of experts needed (Dobbins, 1999). The expert panel needs to have the expertise to achieve the necessary results and be large enough to accomplish these goals (Sutphin, 1981). According to Huber and Delbecq (1972, p. 172), "strategic benefits are obtained by having at least five judges [experts], but the benefits of increasing beyond ten judges is modest." For this study, eight panelists were used, each bringing certain areas of expertise to the study. An expert is an individual having special skills or knowledge derived from training or experience (Gove, 1981). The Delphi panel should have the following qualifications:

1. a strong teaching background at the university and/or secondary school level,
2. a strong background in meat science, and
3. teach meat classes and/or work with meat judging teams.

The Delphi Panel was selected from personal contacts from the meat industry, meat science academia and top ten coaches of National Meat Evaluation Career Development Events (CDE) from 2000 to 2005. Prospective participants were contacted by phone and/or e-mail (Appendix C) and asked to assist with the development of a basic meat science curriculum instrument, including determining topics and standards under each topic. Four from the meat industry and meat science academia agreed to assist with

the study. They were: Thomas Powell, Executive Director, American Meat Science Association AMSA); Dwight Loveday, Faculty, University of Tennessee; Fred Pohlman, Faculty, University of Arkansas; and George Skelley, Professor Emeritus, Clemson University. CDE coaches were selected from coaches of the top 10 FFA National Meats CDE teams from 2000 to 2005. The researcher, under the guidance of Dr. Thomas Dobbins, drafted a letter that was sent to coaches of the top 10 FFA National Meats CDE teams from 2000 to 2005 asking for assistance in the development of the instrument (Appendix B). A total of 36 letters were mailed out asking for assistance with the study and to provide e-mail addresses. The e-mail addresses were used to expedite the exchange of information and reduce the cost of correspondence. Four responses were received stating willingness to assist and two of these were referrals.

The Delphi panel was made up of four experts from the meat industry and academia and four FFA National Meats CDE coaches. Each nominee was contacted by phone or e-mail to determine their availability and interest in being a part of this study. Of the initial nominees contacted, all agreed to participate in the study.

Agricultural Education Teachers

The population for this study was made up of agricultural education teachers from the following six states: Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia. The panel of agricultural education teachers was not a random selection, but a deliberate selection of teachers who teach animal science, and/or animal production courses and participate in career development events (CDE). The National FFA defines a CDE as: the answer to "when will I ever use this in the real world?" Since 1928, FFA

has worked to create CDEs that demonstrate the meaningful connections between classroom instruction and real-life scenarios. CDEs build on what is learned in agriculture classes and the FFA. The events are designed to help prepare students for careers in agriculture. Classroom instruction comes alive as students demonstrate their skills in a competitive setting. CDEs test the ability of individuals and teams in 23 major areas of agriculture instruction. A meat evaluation contest is an example of a CDE (http://www.ffa.org/index.cfm?method=c_programs).

Collection of Data

The procedures associated with data collection in this study included development of a standards survey for a basic meat science curriculum by expert and Delphi panels to be validated by agricultural education teachers. Follow-up procedures included preparation of and mailings to (e-mail included) the expert and Delphi panels. A Web-based survey was used to seek agricultural education teachers input on the list of standards. The online survey was deployed using a special tool in Blackboard (version 6.5). Blackboard is a course management software program that Clemson University uses for class instruction and additional programming was used to provide additional utilities. Blackboard includes a function titled "Organizations" in which Clemson University Computing and Information Technology (CCIT) staff developed a survey tool. The tool allows the researcher to insert questions and choose a mode of response from the population. The survey included an essay-format question that requested the FFA Chapter number of each agricultural education teacher's corresponding school. The chapter number was used to identify the teacher in order to follow up with non-respondents and determine which state

they were from. In addition, the 100 questions that represented the meat science curriculum standards were included in the survey. A dropdown menu was used for the respondents to answer their opinion on each of the meat science curriculum standards. The response choices were "high priority," "moderate priority," "low priority" and "not a priority." A copy of the Web-based survey can be seen under (Appendix U). Survey data were downloaded into an Excel® spread sheet, allowing the researcher to code the literary responses into numerical responses for downloading into SAS® for final data analysis.

An e-mail message (Appendix L) was sent to all agricultural education teachers in the population area asking if they would participate in this study to validate the list of standards developed by expert and Delphi panels. They were also asked to name their preference of an online (Appendix U) or written (Appendix P) survey. Those who indicated they would participate and had requested an online survey were sent the URL link to the Web-based survey. One requested a written survey which was mailed with instructions and responses were added into data set. All participants were asked to validate the standards, on the importance to a basic meat science curriculum. They were not required to be able to teach the standards. The different levels of expertise in meat science were not taken into consideration. The e-mail message contained the deadline date for completion of the survey and additional information the agricultural education teachers would need to complete the survey. The participants were told that the survey would take 45 to 60 minutes to complete. Once the survey was submitted, the teacher could not make changes.

Round 1

The Delphi Panel was asked to add or remove any topic and return the outline to the researcher (Appendix A). The researcher compiled returned outlines and generated a consensus outline (Appendix D) from panel input and returned to the Delphi panel for final approval. The researcher took the consensus outline and added a Likert-type scale. The Likert-type scale, using 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree, was added to each topic. An area below each topic was added for comments.

Round 2

The topic outline (Appendix G) was e-mailed (Appendix E) to the Delphi panel with instructions (Appendix F) to add comments under each topic in the outline. In addition, the panel was instructed to rate each topic on the Likert-type scale and return the instrument to researcher. The researcher compiled returned outlines into a uniform instrument with all returned comments listed under each topic (Appendix I). The researcher calculated the means and standard deviations on each topic (Appendix J). Any topics with a mean of < 2.5 were removed from the study (Appendix S).

The comments left in the study were then separated out under each topic (Appendix K) and a Likert-type scale— Not a Priority, Low Priority, Moderate Priority, and High Priority —were added to each standard (the comments will be referred to as educational standards). With 136 standards, Dr. Skelley further reduced standards to 100 by removing duplicate or similar standards and those that were not clear (Appendix R). One hundred standards were selected to minimize the time needed by the agricultural education teachers to complete the survey to increase the response rate. The topics were

removed for clarity and any possible bias. This completed the instrument and the survey was ready to be sent to agricultural education teachers. Topics were reinstated to the data set for final analysis.

Deployment of the Survey

E-mail letters (Appendix H) were sent to state leaders in Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia asking for assistance with the names and e-mail addresses of agricultural education teachers who teach animal science and/or animal production courses in their state and who also would be willing to assist with the dissertation research.

Florida and Georgia sent complete lists of all teachers and classes taught. The researcher sorted out teachers that met the study criteria of teachers who teach animal science and/or animal production classes. North Carolina, South Carolina and Virginia sent specific lists of teachers who met study criteria. Tennessee sent out the survey through the state office.

An e-mail message (Appendix L) was sent to agricultural education teachers in Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia through their state leaders asking for assistance in completing the survey and their preference of a Web-based or written survey (Appendix N). One requested a written survey which was mailed and the responses were added to final data set. All other responses used the Web-based survey (Appendix O). The agricultural education teachers were asked to rate each standard using a drop down menu. The online survey was deployed using a special tool in Blackboard (version 6.5). Blackboard is a course management software program that

Clemson University uses for class instruction and additional programming was used to provide additional utilities. Blackboard includes a function titled "Organizations" in which Clemson Computing and Information Technology (CCIT) staff developed a survey tool. The tool allows the researcher to insert questions and choose a mode of response from the population. The survey included an essay-format question that requested the FFA Chapter number of each agricultural education teacher's corresponding school. The chapter number was used to identify the teacher in order to follow up with non-respondents and determine which state they were from. This was question 1 on the survey sent to agricultural education teachers; questions 2-101 were the meat science curriculum standards to be validated. A dropdown menu was used for the respondents to answer their opinion on each of the meat science curriculum standards. The response choices were "high priority," "moderate priority," "low priority" and "not a priority." A copy of the Web-based survey can be seen under (Appendix U). Three e-mail reminders were sent to non-responders at three- to four-week intervals from launch of survey (Appendix M).

Treatment of Data

The results from the Delphi panelists were compiled to establish a list of standards to be validated by the agricultural education teachers. The agricultural education teachers ranked each standard on a four-point Likert-type scale—high priority, moderate priority, low priority, and not a priority. Teacher responses on survey were coded to number representation of four to one, respectively, before analysis. Using SAS®, means and standard deviations were calculated on each standard. Grand mean and standard

deviation for each basic meat science topic were calculated using the basic meat science standards means and standard deviations under each topic. Standards with a mean < 2.5 and/or standard deviation > 1.0 were removed (Appendix W)

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA, SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This Chapter contains findings to the objectives of the study. The findings were generated using a modified Delphi technique and two rounds of questions to develop basic meat science curriculum topics and a standards instrument. A Web-based survey was sent to agricultural education teachers from six southern and mid-Atlantic States. The findings are organized as:

1. deployment of survey,
2. results of the agricultural education teachers' survey,
3. discussion of findings,
4. conclusions and recommendations,
5. limitations of the study.

Deployment of the Survey Instrument

State Leaders from Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia aided in this study by providing information on their teachers who teach animal science and/or animal production courses. The researcher selected 81 teachers that met the study criteria (Table 1) and sent the survey's URL via e-mail with instructions on how to complete the survey. One requested a paper survey response. This response was added to the final data set. Three e-mail reminders were sent to non-responders at three- to four-week intervals from the launch of the survey (Appendix M).

Table 1. Data on Distribution and Responses of Surveys: n = 52

State	Number of Surveys Sent	Number of Responses	Percentage Return
Florida	20	18	90
Georgia	15	2	13
North Carolina	11	4	36
South Carolina	16	16	100
Tennessee	15	11	73
Virginia	4	1	25
Totals	81	52	64

Agricultural education teachers were asked to rate each standard using a drop-down menu. The selections were Not a Priority, Low Priority, Moderate Priority, and High Priority. A Likert-type scale was converted to numbers using 1 = Not a Priority, 2 = Low Priority, 3 = Moderate Priority, and 4 = High Priority. Data were analyzed using means and standard deviation. Standards with a mean of < 2.5 and a standard deviation of > 1.0 were removed before final topic analysis.

Results of the Agricultural Education Teachers' Survey

Eighty-one e-mails were sent to agricultural education teachers in six southern and Mid-Atlantic States based on study criteria. The e-mail message contained the following request for participation, the survey's URL, and instructions explaining how to answer the on-line survey (Appendix M). Based on study criteria, the number of teachers

surveyed varied due to the number of teachers that teach animal science and/or animal production from state to state.

Florida and Georgia were selected from the complete list of agriculture education teachers and courses taught. The researcher selected 20 from Florida with a response rate of 18 (90%) and 15 from Georgia with a response rate of 2 (13%). The Tennessee surveys were sent through the State Leader. Fifteen were sent with a return rate of 11 (73%). Eleven surveys were sent to North Carolina; four were returned for a response rate of (36%). Sixteen surveys were sent to South Carolina; 16 were returned with a response rate of (100%). Four surveys were sent to Virginia with one returned for a return rate of (25%). A total of 81 surveys were sent with 52 responses for a total return rate of (64%).

The agricultural education teachers that responded to the survey rated 100 basic meat science standards using a drop down menu of Not a Priority, Low Priority, Moderate Priority, and High Priority. Excel® allowed the researcher to code the 1 = Not a Priority, 2 = Low Priority, 3 = Moderate Priority, and 4 = High Priority for final analysis of the data. The topics were added back into the data set for analysis. The analyses on the topics are presented in Table 2. Means and standard deviations were calculated using the means and standard deviations of the basic meat science standards/ competencies under each topic (Table 3).

The study found 17 topics (68%) rated moderate to high priority with a mean greater than 3.0 and eight (32%) topics in the low priority with a mean of less than 3.0,

Table 2. Mean and Standard Deviation for Basic Meat Science Topics

Topic	Mean	Standard Deviation
Visit to a Supermarket	3.67	0.49
Retail Cuts	3.59	0.62
Harvest	3.47	0.57
Sanitation, SOP, GMP	3.44	0.57
Microbiology, Meat as a Culture	3.40	0.61
Quality Grade	3.37	0.62
Color	3.35	0.65
Yield Grade	3.29	0.65
Class Placing of Meat	3.27	0.69
Fresh Meat Properties	3.23	0.60
Grading of Meat	3.21	0.83
Identification of Meat	3.20	0.68
Meat as a Part of Culture	3.17	0.52
Food Groups	3.15	0.59
Inedible By-products	3.14	0.66
Fabrication	3.13	0.67
Inspection	3.10	0.62
Hazard Analysis of Critical Control Points (HACCP)	2.96	0.73
Nutrition of Meat	2.94	0.70
Edible By-products	2.94	0.66
History	2.92	0.63
Report of Survey to Class	2.90	0.73
Value Added Processing	2.82	0.63
Sausage	2.78	0.75
Curing and Smoking	2.77	0.71

4 = High Priority, 3 = Moderate Priority, 2 = Low Priority, and 1 = Not a Priority.

*Line divides table between high, moderate priority and low, not a priority.

See Appendix T for definitions and explanation of topics in Table 2.

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education

		Mean	Standard Deviation
History		2.92	0.63
	The student will be able to:		
1	know the historical events that changed or modified the industry (refrigeration and “The Jungle");	2.78	0.82
2	know the history of the meat packing industry, noting the changes from the northeastern states to the central plains states (refrigeration, railroads, interstate highway systems, disassembly of carcass from Henry Ford assembly);	2.83	0.81
3	show how American History and Meat Science are closely related;	2.87	0.84
4	observe the how and why the meat industry has evolved, including technological innovations and changes in processing centers.	3.21	0.75
Meat as a Part of Culture		3.17	0.52
	The student will be able to:		
5	observe the relative changes in consumer consumption of meat products over the past 100 years;	3.44	0.67
6	know what caused these changes and the history of meat consumption in various cultures around the world;	3.21	0.72
7	recognize that meat helps determine the culture of the people;	2.83	0.79
8	know what drives meat consumption as related to culture and how the industry fits or might fit in the future.	3.19	0.63
Visit to the Supermarket		3.67	0.49
	The student will be able to:		
10	identify retail cuts in meat counter and be able to determine what cut you want to buy;	3.67	0.65
11	Identify products by label, species, cuts (wholesale and retail), meat label components, case ready products, type of packaging;	3.65	0.56
12	Begin to know the movement of meat from farm to table.	3.67	0.55
Report of Survey to Class		2.90	0.73
	The student will be able to:		
13	discuss findings of supermarket survey;	2.59	0.82
14	report on findings of supermarket survey, research a topic in new technology/research in meat science for tenderness, juiciness, and flavor, ready to eat meats, heat and serve, and/or value added meat products (flat-iron steak);	2.98	0.88
15	relate their ideas from supermarket study of meat and the consumer.	2.90	0.87
16	process what they have learned from supermarket survey and communicate their findings to others.	3.20	0.80

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Harvest		3.47	0.57
	The student will be able to:		
17	know all factors affecting the animal body pre-harvest and how these factors affect the final product;	3.35	0.74
18	observe how an animal is slaughtered and what parts are removed from the animal during harvest;	3.57	0.67
19	realize the science and art of meat animal harvest;	3.92	0.70
20	know general terms of how animals are harvested and what factors relate to meat quality.	3.57	0.61
Color		3.35	0.65
	The student will be able to:		
21	explain the physiological changes in muscle color and the factors that affect these changes;	3.25	0.74
22	describe the differences in color from beef, lamb, and pork--both smoked and fresh--and also learn what PSE (pale, soft, and exudative) meat looks like as well as old and youthful;	3.31	0.81
23	identify normal, superior and inferior color of meat, as it deals with retail identification, freshness, and quality;	3.50	0.80
24	recognize and know changes in meat color;	3.37	0.74
25	know how color is developed and why color is important.	3.35	0.74
Fresh Meat Properties		3.23	0.60
	The student will be able to:		
26	know the properties of fresh meat post-mortem and how these properties affect the final fresh meat product;	3.23	0.73
27	identify those properties that will be readily accepted or rejected by consumers;	3.52	0.67
28	know the importance of water holding capacity (WHC);	2.81	0.79
29	know what factors influence fresh meat properties and how this relates to meat quality characteristics.	3.27	0.77
Fabrication		3.13	0.67
	The student will be able to:		
30	cut carcasses into main wholesale cuts distinguishing between the high merchandizing valued middle-meats and other cuts;	3.42	0.82
31	observe fabrication at a local processing plant;	3.06	0.92
32	know the need for boxed product to fill large orders of special cuts;	2.79	0.82
33	identify where retail cuts are found and validate carcass classes and wholesale cuts to determine level of quality.	3.56	0.73

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Retail Cuts		3.59	0.62
	The student will be able to:		
34	identify meat cuts by species and name the wholesale cuts, including smoked products;	3.62	0.63
35	identify common retail cuts of beef, pork, and lamb and validate classes of retail cuts from a consumer's perspective;	3.71	0.64
36	begin to recognize individual retail cuts from the different wholesale cuts of a specific species;	3.49	0.73
37	identify general retail cuts, anatomy of muscle and bone, and where cuts originate.	3.44	0.80
Quality Grade		3.38	0.62
	The student will be able to:		
38	determine the age and marbling scores of swinging beef carcasses and correct quality grade;	3.21	0.78
39	know beef USDA quality grades, determine inferior quality of pork and lamb and the use of this information to validate classes of carcasses, wholesale and retail cuts;	3.50	0.67
40	become familiar with these grades and their usefulness in pricing and acceptability of the product;	3.37	0.71
41	determine quality grades, factors involved, what influences them, and why they are important.	3.37	0.74
Yield Grade		3.29	0.65
	The student will be able to:		
42	determine Preliminary Yield Grade (PYG);	3.12	0.81
43	determine USDA beef yield grade, determine trimness and muscling of pork and lamb and use this information in the evaluation of carcass classes, wholesale and retail cuts;	3.35	0.71
44	become familiar with the grades and their usefulness in pricing and acceptability of product at the wholesale level;	3.33	0.68
45	determine yield grades, what influences them, and how to improve cutability.	3.33	0.74
Sanitation, SOP, GMP		3.44	0.57
	The student will be able to:		
46	demonstrate the relative importance of sanitation in a meat facility, relay the importance of standard operating procedures (SOP)) for daily sanitation operations and inspection;	3.38	0.87
47	know the proper cooking temperatures for meat;	3.39	0.78
48	identify safe and unsafe sanitation practices;	3.63	0.60
49	use sanitation principles in combination with meat micro to appreciate a clean environment.	3.38	0.72

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Microbiology, Meat as a Culture		3.40	0.61
	The student will be able to:		
50	know the importance of sanitation and environment on various types of microorganisms and how the condition of the meat facility affects bacterial growth;	3.41	0.70
51	know factors that affect microorganism contamination and growth;	3.35	0.76
52	realize the potential of any food hazard and ways to control;	3.50	0.67
53	know the microbiological threat to food safety of meat, what factors influence food safety, and how to improve.	3.29	0.82
Inspection		3.10	0.62
	The student will be able to:		
54	know the importance of USDA inspection in the US, convey why the Meat Inspection ACT was passed;	3.29	0.75
56	discuss parts of a carcass a meat inspector will look at to determine wholesomeness;	3.08	0.88
57	know how meat inspection has evolved and relates to a safe and wholesome meat supply.	3.13	0.82
Hazard Analysis of Critical Control Points (HACCP)		2.96	0.73
	The student will be able to:		
59	know the principles of HACCP, but not develop a plan;	2.63	0.93
60	note that all personnel involved in the meat chain are indeed responsible for the safety of the food on the consumer's table;	3.35	0.81
61	know what HACCP is and what's involved in creating a HACCP plan without the development of an individual plan.	2.81	0.95
Food Groups		3.15	0.59
	The student will be able to:		
62	use the newest food pyramid to establish a healthy diet with all essential nutrients;	3.10	0.77
63	identify what the major food groups are and why meat is important to an individual's diet;	3.25	0.76
64	know the importance of meat in the human food supply;	3.48	0.74
65	know what constitutes the food groups and how to follow the new food guide pyramid.	3.08	0.88

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Nutrition of Meat		2.94	0.70
	The student will be able to:		
66	recite the relative composition of meat products, including protein, fat, minerals, vitamins, and any necessary elements that are not provided by other food stuff;	2.92	0.82
67	discuss the nutrient density of meat and identify the major vitamins and minerals found in meat;	2.87	0.82
68	know the vast amount of nutrients that are in the hamburger and other meat products;	2.88	0.88
69	know the nutrient composition of meat and how meat fits into a wholesome healthy diet.	2.98	0.78
Curing and Smoking		2.77	0.71
	The student will be able to:		
70	know the chemical properties and the changes that occur in smoked and cured products;	2.60	0.87
71	identify and discuss various chemicals and why they are used;	2.62	0.91
72	know the basic principles of curing and smoking;	2.90	0.85
73	know the changes that occur during the process of curing and smoking.	2.87	0.89
Sausage		2.78	0.75
	The student will be able to:		
74	differentiate between the origins of sausages from their names, observe the different ingredients used in various types of sausage, and distinguish between the different types of casing;	2.63	0.84
75	discuss why we grind, smoke, and cure meat;	2.92	0.86
76	become acquainted with the most important and largest groups of meat compounds;	2.71	0.76
77	know the major product forms, production process for sausage, an appreciation for casing types and process techniques used in sausage manufacturing.	2.61	0.87
Value Added Processing		2.83	0.63
	The student will be able to:		
78	know the importance of research to find or add value to products that were once considered of low value and to find niche markets;	2.72	0.88
79	identify and discuss ways to add value to carcasses and primal cuts by processing (ex. Flat-Iron steak);	3.04	0.71
80	know the importance of continued studies and research to obtain new products and new systems of selling meat products;	2.88	0.73
81	know the major processes involved with adding value to whole muscle and comminuted meat.	2.52	0.75

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Edible By-products		2.94	0.66
	The student will be able to:		
82	learn what variety meats are from the three species;	3.21	0.82
83	identify various edible by-products by sight and discuss their uses;	3.08	0.86
84	see the great diversity that edible by-products bring to meat food groups;	2.94	0.84
85	know the harvesting process and uses for animal by-products.	3.04	0.79
Inedible By-products		3.14	0.66
	The student will be able to:		
86	list and explain the various type of medical, health, beauty, aesthetic, and other products that come as by-products of the meat industry;	3.31	0.70
87	discuss the uses of inedible by-products;	3.15	0.83
88	become aware of the importance of inedible by-products;	3.10	0.85
89	know the harvest, processing, and uses for major inedible by-products.	2.82	0.79
Identification of Meat		3.20	0.68
	The student will be able to:		
90	identify and differentiate various species, wholesale, and retail cuts of meat--fresh, smoked or cured;	3.25	0.88
91	identify a variety of meats that come from different species and relate the importance of these cuts in terms of merchandizing;	3.21	0.85
92	identify retail cuts by species, primal cut and retail names of beef, pork, and lamb;	3.52	0.73
93	Determine cut identification, primal cut and species of origin for meat cuts.	3.42	0.75
Grading of Meat		3.21	0.83
	The student will be able to:		
94	calculate USDA quality and yield grades of beef carcasses and know the concepts behind calculated muscling in pork, US grades, and how to calculate USDA quality and yield lamb carcasses;	3.15	1.00
95	calculate beef USDA quality and yield grade to within a third of a grade;	3.00	0.98
96	determine quality and yield grades for beef carcasses.	3.29	0.85
Class Placing of Meat		3.27	0.69
	The student will be able to:		
97	know the placing criteria for the different cuts in the contest;	3.17	0.92
98	validate beef, pork, and lamb carcasses, primal and retail cuts;	3.35	0.79
99	know consumer decision making;	3.30	0.74
100	develop problem solving skills by determining value of meat carcass or cut's classes.	3.25	0.95

but greater than 2.0 and none of the topics were rated not a priority. All topics had a SD ≤ 1.0 confirming a high level of agreement among Agricultural education teachers.

Discussion of Findings

The expert and Delphi panels developed 25 Basic Meat Science topics and 100 Basic Meat Science standards through the use of a modified Delphi technique starting with a college introductory meat science syllabi. This instrument survey was then sent to agriculture education teachers in six southern and mid-Atlantic states: Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia. Means and standard deviations were calculated. Topics were ranked in descending order by mean. The study found 17 topics (68%) in the moderate to high priority with a mean > 3.0, eight (32%) topics in the low priority with a mean of < 3.0 but > 2.0, and none of the topics were rated not a priority. All topics had a SD ≤ 1.0 confirming a high level of agreement among agricultural education teachers.

Development of basic meat science topics and standards by the Delphi panel and validated by agricultural education teachers gives basis to the development of a basic meat science curriculum for secondary agricultural education. This ranking allows for an outline of the topics in the moderate to high priority and associated standards to start the development of a basic meat science curriculum. These topics include: visit to a super-market, retail cuts, harvest, sanitation (SOP, GMP), microbiology (meat as a culture), quality grade, color, yield grade, class placing of meat, fresh meat properties, grading of meat, identification of meat, meat as a part of culture, food groups, inedible by-products, fabrication, and inspection. Explanation of the topics can be found in Appendix T.

Conclusions and Recommendations

Based on the findings of the study, 17 topics (68%) ranked in the moderate to high priority category with a mean > 3.0, eight (32%) topics ranked in the low priority category with a mean of < 3.0 but > 2.0, and none of the topics were rated not a priority. All topics had a SD ≤ 1.0 confirming a high level of agreement among agricultural education teachers. According to the findings of this study, there is a definite need for a basic meat science curriculum at the secondary agricultural education school level in the states included in this study, as all topics were rated at high, moderate, or low priority. None of the topics or standards were rated not a priority. As society changes with fewer and fewer full time homemakers to teach food safety, CDC reports weekly of microbial outbreaks in foods and how this affects the safety of the general public.

> CDC's Outbreak Net Team conducted a multi-state case-control study in collaboration with health authorities in Ohio and Michigan to epidemiologically (the branch of medical science concerned with the occurrence and control of disease in populations) examine exposures that might be related to illness. The data indicate a significant association between illness and eating ground beef purchased at one of several Kroger® stores in Michigan and Ohio. CDC has provided these results to USDA-FSIS and public health agencies in Michigan and Ohio (retrieved 25 Aug 2008) (Appendix Q).
> http://www.cdc.gov/ecoli/june2008outbreak/index_071608.html

So, must our education system change in the area of meat science? The meat and food industry continues to develop, with a variety of job opportunities. With established meat science programs at the collegiate level and the continuing expansion of the food industry, it's only logical to establish basic meat science programs at the secondary agricultural education level to become feeder programs in conjunction with culinary arts

programs for higher education and the food industry giving students another path to employment and careers after completing high school.

The topics and standards developed by the expert and Delphi panels and rated by the agricultural education teachers can be used in the development of a basic meat science curriculum. The ranking will allow for discretion by agriculture education teachers when funds and time are limited to teach the more important topics and standards.

The modified Delphi technique was used in this study to develop the survey instrument. This technique provides a more effective method of allowing for exchange of opinions without face-to-face interaction. Starting with a topic outline reduces the number of rounds needed to develop the survey instrument with the use of e-mail as the means to exchange these opinions. This method reduced the cost to complete the study.

The recommendations listed in this section are based on the findings of the study.

1. The secondary agriculture education programs should consider the development of a national standardized basic meat science curriculum to address the needs of students, society and industry. The topics and standards developed and validated in this study could be used to develop a basic meat science curriculum.

2. Replication of this study should be conducted on a national level.

3. Agricultural education teacher education in the area of basic meat science is important. Workshops should be developed to assist agricultural education teachers with the necessary knowledge and techniques needed to teach basic meat science courses.

4. Basic meat science curriculum textbook and teaching materials should be developed based on the rank order results provided by the agricultural education teachers.

5. Study needs to be expanded to poultry CDE coaches. This study removed all poultry topics and standards. Delphi panel members were from livestock and meat background without poultry experience.

Limitations of the Study

This was a regional study, which developed the topics and standards for a basic meat science curriculum for agricultural education programs in secondary schools. Study data were collected from expert and Delphi panels made up of experts in the field of meat science and agricultural education teachers. Certain inherent limitations occurred in the study and were taken under consideration at the conclusion of the study.

Possible limitations to the study include:

1. topics and standards may be subject to bias, as consideration of the expert and Delphi panels' ability, accuracy, and objectivity of responses was not validated;
2. teachers had different levels of expertise when they validated the standards;
3. the study involved only six states thus limiting broader assumptions.

CHAPTER V

JOURNAL ARTICLES

Development of Basic Meat Science Topics and Standards Survey Instrument by Expert and Delphi Panels

John K. Duke, Thomas R. Dobbins, William D. Page, Lawrence W. Grimes, Donnie R. King, K. Dale Layfield

Abstract

The purpose of this study was to develop basic meat science topics and standards for secondary agriculture education. Expert and Delphi panels were used to develop the instrument. The expert panel was made up of meat science faculty and the Delphi panel was composed of four members from academia and industry and four from the top ten national meat FFA Career Development Events coaches from 2000 to 2005. Two Delphi rounds were used to develop the survey instrument. The modified Delphi started with an outline of basic meat science topics developed by the expert panel from 16 university basic meat science syllabi. The Delphi panel added or deleted topics, topics were consolidated into an outline, and a Likert-type scale was added. Topics with a mean < 2.5 were removed. Standards were added to each topic, standards were combined, and a Likert-type scale added. Standards with a mean < 2.5 were removed leaving 136 standards. Duplicate, similar, and those not clear were removed to leave 100 standards.

Keywords: curriculum, Delphi, education, standards, topics

Introduction

As we venture into the 21st century, the need has arisen for Food Safety and Preparation Education. Rasmussen (1989) in 1850, 11,680,000 farm residents made up 50 percent of the population and 64 percent of the labor force (p. 20). In 1918, Secretary of Agriculture David F. Houston reported on the first year's operation of the Smith-Leaver Act. He stated that "women county agents" had worked on topics related to the physical well-being of families - home conveniences, eradication of flies and mosquitoes, proper preparation of food, care of poultry, and marketing of eggs. Approximately 50,000 homes had been visited, and those families had been given helpful suggestions. Six thousand farm women had presented special demonstrations in home improvements to fellow homemakers (p. 154). As we grew through the 20th century, we had a significant societal change in the family structure. More women wanted to and were required to work outside the home to help maintain fiscal responsibility. This contributed to a generation of people who are uneducated about home economics, food safety, and basic survival techniques (p. 155). Without strong home instruction in food safety and preparation, it is necessary for instruction to occur at the secondary school level.

History of American Agriculture: Agricultural Education & Extension lists several events that contributed to the development of agricultural education: The Morrill Acts of 1862 and 1890 were the first major acts of legislation to address the problem of societal difference in education with the establishment of land grant institutions. With passing of the Smith-Hughes Act of 1917, vocational education changed significantly. This allowed federal money to go into state coffers, allowing the average individual to

attend institutes of higher learning, previously only available to the elite of society. As we continued through the 20th century, several other acts of legislation were passed to benefit vocational education. These acts included the George-Dean Act of 1934, the National Defense Education Act of 1958, the Vocational Education Act of 1963, and the Carl D. Perkins Vocational Education Act of 1984.

The George-Dean Act of 1934 supplemented the areas of agriculture, home economics, trade, and industrial education. The National Defense Education Act of 1958 responded to the launching of the Russian satellite Sputnik. This event put current technical and scientific education under the microscope which resulted in a miserable failure. Congress was appalled at the results and passed legislation addressing the problem. The Vocational Education Act of 1963, also known as the Perkins-Morse bill, affirmed the federal government's commitment to vocational education as an essential part of the common welfare and defense of the country, giving technical and industrial education a needed economic boost. The Vocational Education Amendments of 1967 basically cancelled all previous legislation except the Smith-Hughes Act, which was retained as the first legislation for vocational education at the secondary level. The Carl D. Perkins Vocational Education Act of 1984 showed a philosophical change in Congress. The importance of vocational educational was realized by Congress with the administration handled at the local level (http://www.agclassroom.org/gan/timeline/ag_ed.htm.)

Hewitt (2006) stated that, concerning schools and schooling, there are two familiar contemporary examples. The report of the National Commission on excellence in Education of 1983, *A Nation at Risk,* initiated a national school reform movement that

took different forms depending on how political parties and interest groups coalesced on particular aspects of the report. The legacy of that report, the impetus to and emphasis on reform, continues today. The importance of the report was not its effect on direct policy making but promoting different approaches to reform rather than using the governing apparatus of the state and the law. That changed with the most recent reform initiative, the No Child Left Behind (NCLB) Act of 2001, signed into law in 2002. This act is the latest reincarnation of the Elementary and Secondary Education Act dating from the 1960s. The NCLB Act is a comprehensive accountability program based on extensive testing and increased financial support for schools meeting particular mandates such as developing curriculum standards, establishing comparative student performance levels across states, and assuring teacher quality in the areas of curriculum expertise. Reform, standards, associated coats, and the NCLB Act are major educational policy issues with important curriculum implications. The importance is the shift from policy initiatives resulting from reports and reformers to direct policy making by law (pp. 54-55).

Background for this Study

Vocational education needs have changed significantly over the 20th century with the current migration of young people off the farms. Therefore, a need has arisen for the development of educational techniques in the curriculum of basic meat science. Meat science has grown extensively in the area of technology during the 20th century. The food science industry is a billion dollar a year industry. While several two-year institutions, four-year colleges and universities offer meat science courses and degrees, this is a new concept at the secondary school level (Stuska, 1993). According to

Rasmussen (1989) changes of the 20th century, developed the need for changes in agricultural education. Farmers need more technical education to fill the agricultural needs of the 21st century. The farm labor force has decreased significantly and family farms have given away to corporate farms. Children of farmers are moving from rural to urban areas. With the constant change in agricultural education, we need to have in place a more effectively trained workforce for the high tech agriculture industry of today. This educational groundwork will need to start at the secondary school level (pp. 3-4). Currently there is not a nationally recognized basic meat science curriculum; however, several states do have a basic meat science curriculum.

CDC reports weekly of microbial outbreaks in foods and how this affects the safety of the general public:

> CDC's Outbreak Net Team conducted a multi-state case-control study in collaboration with health authorities in Ohio and Michigan to epidemiologically (the branch of medical science concerned with the occurrence and control of disease in populations) examine exposures that might be related to illness. The data indicate a significant association between illness and eating ground beef purchased at one of several Kroger® stores in Michigan and Ohio. CDC has provided these results to USDA-FSIS and public health agencies in Michigan and Ohio (retrieved 25 Aug 2008) http://www.cdc.gov/ecoli/june2008outbreak/index_071608.html

Problem Statement

In today's world, concern with food safety is an everyday issue and occurrence. Thus, development and evaluation of basic meat science curriculum standards at the secondary agricultural school level is essential. Consideration of sanitation, preparation, carcass handling, meat processing, meat fabrication (cutting), and carcass harvesting is essential and needs to be validated in a basic meat science curriculum.

Purpose and Objectives

The purpose of this research is to develop a list of meat science topics and standards for a basic meat science curriculum in secondary agricultural education using expert and Delphi panels with validation by agricultural education teachers. The expert and Delphi panels' participants were selected from industry and academia. Teachers' representatives were current agricultural education teachers from six southern and mid-Atlantic states—Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

The following objectives will be established in conducting this research:

1. develop basic meat science topics for a basic meat science curriculum at the secondary agricultural education school level,
1. develop a list of standards under each topic to validate a basic meat science curriculum at the secondary agricultural school level,
2. have standards validated by current agricultural education teachers who teach animal science and/or animal production courses.

Materials and Methods

This study used expert and Delphi panels to develop a list of basic meat science topics. Experts were selected for this study based on meeting the criteria of:

1. teaching meat science courses at the college level,
2. coaching meat/livestock judging teams, and
3. participating on a collegiate meats/livestock judging team.

The following were selected and agreed to serve on the expert panel. The expert panel consisted of Dr. George Skelley, Professor Emeritus Meat Science, Animal and

Veterinary Sciences, Clemson University, Dr. Melvin Hunt, meat science faculty at Kansas State University assisted by other meat science faculty at Kansas State University. The expert panel combined basic meat science course syllabi from introductory meat science courses from the following universities: Auburn University, The University of Arkansas, Clemson University, The University of Florida, The University of Georgia, Kansas State University, The University of Minnesota, Montana State University, The Ohio State University, Oklahoma State University, Oregon State University, South Dakota State University, The University of Tennessee, Texas A&M University, The University of West Virginia, and The University of Wyoming into a general outline of basic meat science topics. The syllabi were obtained from university web sites or personal contacts.

A validation panel was made up of Drs. Thomas R. Dobbins, Donnie R. King, Phillip M. Fravel, and K. Dale Layfield, agricultural education faculty at Clemson University was formed to validate the different aspects of the study.

Expert and Delphi panels were used to develop a basic meat science topics and standards. Standards were validated by secondary school agricultural education teachers. The teachers were asked to rate 100 basic meat science curriculum standards based on a range from "Not a Priority" to "High Priority". A modified Delphi research technique was used in this study to develop a list of basic meat science curriculum topics with standards for each topic for secondary agricultural education. Delphi is a proven method used to bring many opinions to a consensus. Custer, Scarcella, and Stewart (1999) noted:

> The modified Delphi Technique is similar to the full Delphi in terms of procedure (i.e., a series of rounds with selected experts) and intent (i.e., to

> predict future events and to arrive at consensus). The major modification consists of beginning the process with a set of carefully selected items. These pre-selected items may be drawn from various sources including related competency profiles, synthesized reviews of the literature, and interviews with selected content experts. (JVET, 1999, 15(2), p. 2).

Two rounds were used to develop the basic meat science curriculum topics with standards for each topic. Upon the completion of Round 2, expert and Delphi panels established the survey of standards for a basic meat science curriculum in secondary agricultural education. Using a Web-based survey, the standards were ranked on a four-point Likert-type scale—Not a Priority, Low Priority, Moderate Priority, and High Priority. Prior to final analysis of the data, the Likert-type scale was coded to numbers: 1 = Not a Priority, 2 = Low Priority, 3 = Moderate Priority, and 4 = High Priority.

Population

Guidelines on the specific number of experts required on a Delphi panel are not available. In a study by Sutphin (1981), seven experts were used, while other studies have used up to 100 experts. The type of study and the expense of having a large number of experts will determine the number of experts needed (Dobbins, 1999). The expert panel needs to have the expertise to achieve the necessary results and be large enough to accomplish these goals (Sutphin, 1981). According to Huber and Delbecq (1972, p. 172), "strategic benefits are obtained by having at least five judges [experts], but the benefits of increasing beyond ten judges is modest." For this study, eight panelists were used, each bringing certain areas of expertise to the study. An expert is an individual having special skills or knowledge derived from training or experience (Gove, 1981). The expert and Delphi panels should have the following qualifications:

1. a strong teaching background at the university and/or secondary school level,
2. a strong background in meat science,
3. teach meat classes and/or work with meat judging teams.

The expert and Delphi panels were selected from personal contacts from the meat industry, meat science academia and top ten coaches of National Meat Evaluation Career Development Events (CDE) from 2000 to 2005. Prospective participants were contacted by phone and/or e-mail and asked to assist with the development of a basic meat science curriculum instrument, including determining topics and standards under each topic. The expert panel was made up of meat science faculty. The Delphi panel was made up of four individuals from the meat industry and meat science academia who agreed to assist with the study. They were: Thomas Powell, Executive Director, American Meat Science Association AMSA); Dwight Loveday, Faculty, University of Tennessee; Fred Pohlman, Faculty, University of Arkansas; and George Skelley, Professor Emeritus, Clemson University. CDE coaches were selected from coaches of the top 10 FFA National Meats CDE teams from 2000 to 2005. The researcher, under the guidance of Dr. Thomas Dobbins, drafted a letter that was sent to coaches of the top 10 FFA National Meats CDE teams from 2000 to 2005 asking for assistance in the development of the instrument. A total of 36 letters were mailed out asking for assistance with the study and to provide e-mail addresses. The e-mail addresses were used to expedite the exchange of information and reduce the cost of correspondence. Four responses were received stating willingness to assist and two of these were referrals.

The Delphi panel was made up of four experts from the meat industry and academia and four coaches from top 10 FFA National Meats CDE from 2000 to 2005. Each nominee was contacted by phone or e-mail to determine their availability and interest in being a part of this study. Of the initial nominees contacted, all agreed to participate in the study.

Collection of Data

The procedures associated with data collection in this study included development of a standards survey for a basic meat science curriculum by expert and Delphi panels to be validated by agricultural education teachers. Follow-up procedures included preparation of and mailings to (e-mail included) the Delphi panel

Round 1

The Delphi Panel was asked to add or remove any topic and return the outline to the researcher. The researcher compiled returned outlines and generated a consensus outline from panel input and returned to the Delphi panel for final approval. The researcher took the consensus outline and added a Likert-type scale. The Likert-type scale, using 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree, was added to each topic. An area below each topic was added for comments.

Round 2

The topic outline was e-mailed to the Delphi panel with instructions to add comments under each topic in the outline. In addition, the panel was instructed to rate each topic on the Likert-type scale and return the instrument to researcher. The

researcher compiled returned outlines into a uniform instrument with all returned comments listed under each topic. The researcher calculated the means and standard deviations on each topic. Any topic with a mean of < 2.5 was removed from study.

The comments left in the study were then separated out under each topic and a Likert-type scale— Not a Priority, Low Priority, Moderate Priority, and High Priority— was added to each standard (the comments will be referred to as educational standards). With 136 standards, Dr. Skelley and the researcher further reduced standards to 100 by removing the duplicate or similar standards and those that were not clear. One hundred standards were selected to minimize the time needed by the agricultural education teachers to complete the survey to increase the response rate. The topics were removed for clarity and any possible bias. This completed the instrument and the survey was ready to be sent to agricultural education teachers. Topics were reinstated to the data set for final analysis. The results are presented in Table 1.

Treatment of Data

The results from the expert and Delphi panelists were compiled to establish a list of standards to be validated by the agricultural education teachers.

Discussion of Findings

The expert and Delphi panels developed 25 Basic Meat Science topics and 100 Basic Meat Science standards through the use of a modified Delphi technique starting with college introductory meat science syllabi.

Table 1 Mean and Standard Deviation for Basic Meat Science Topics

Topic	Mean	Standard Deviation	RND	Mean < 2.5 Removed
Visit to a Supermarket	3.57	0.53	2	
Retail Cuts	3.63	0.52	2	
Harvest	3.25	0.71	2	
Sanitation, SOP, GMP	2.57	1.27	2	
Microbiology, Meat as a Culture	3.25	1.04	2	
Quality Grade	3.63	0.74	2	
Color	3.62	0.52	2	
Yield Grade	3.75	0.46	2	
Class Placing of Meat	3.14	1.21	2	
Fresh Meat Properties	3.63	0.52	2	
Grading of Meat	3.14	1.21	2	
Identification of Meat	3.29	1.11	2	
Meat as a Part of Culture	2.75	0.89	2	
Food Groups	2.71	1.60	2	
Inedible By-products	3.29	1.11	2	
Fabrication	3.38	0.74	2	
Inspection	3.13	0.83	2	
Hazard Analysis of Critical Control Points (HACCP)	2.71	1.11	2	
Nutrition of Meat	3.00	1.41	2	
Edible By-products	3.00	1.15	2	
History	3.00	1.15	2	
Report of Survey to Class	2.57	0.98	2	
Value Added Processing	3.00	1.07	2	
Sausage	2.50	1.31	2	
Curing and Smoking	2.88	0.99	2	
Meat and World Hunger	2.29	0.76	2	X
Meats Written	2.33	0.76	2	X
Poultry Class Placing	1.67	0.82	2	X
Poultry Quality Grade	2.14	1.21	2	X
Eggs	1.57	0.98	2	X
Poultry Further Processing	1.83	1.33	2	X

Conclusions and Recommendations

The recommendations listed in this section are based on the findings of the study.

1. The secondary agriculture education programs should consider the development of a national standardized basic meat science curriculum to address the needs of students, society and industry. The topics and standards developed and validated in this study could be used to develop a basic meat science curriculum.

2. Agricultural education teacher education in the area of basic meat science is important. Workshops should be developed to assist agricultural education teachers with the necessary knowledge and techniques needed to teach basic meat science courses.

3. Basic meat science curriculum textbook and teaching materials should be developed based on the rank order results provided by the agricultural education teachers.

4. Study needs to be expanded to poultry CDE coaches. This study removed all poultry topics and standards. Delphi panel members were from livestock and meat background with out poultry experience.

Limitations of the Study

This was a regional study, which developed the topics and standards for a basic meat science curriculum for agricultural education programs in secondary schools. Study data were collected from expert and Delphi panels made up of experts in the field of meat science and agricultural education teachers. Certain inherent limitations occurred in the study and were taken under consideration at the conclusion of the study.

Possible limitation to the study:

1. topics and standards may be subject to bias, as consideration of expert and Delphi panels' ability, accuracy, and objectivity of responses were not validated;

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Deployment of Basic Meat Science Curriculum
Topics and Standards Survey Instrument.

John K. Duke, Thomas R. Dobbins, William D. Paige, Lawrence W. Grimes, Donnie R. King, K. Dale Layfield.

Abstract

The purpose of this study was to develop basic meat science topics and standards for secondary agricultural education. Expert and Delphi panels were used to develop the instrument. The expert panel was made up of meat science faculty. The Delphi panel was composed of four members from academia and industry and four from the top ten national meat FFA Career Development Events coaches from 2000 to 2005. Two Delphi rounds were used to develop the survey instrument. The modified Delphi started with an outline of basic meat science topics developed by expert panel from 16 university basic meat science syllabi. The Delphi panel added or deleted topics, topics were consolidated into an outline, and a Likert-type scale was added. Topics with a mean < 2.5 were removed. Standards were added to each topic, standards were combined, and a Likert-type scale added. Initially 136 standards were reduced to 100 by removing duplicate, similar and those not clear. Agricultural education teachers from six southern states were asked to validate each standard using a Web-based survey with a drop-down menu of 4 = high, 3 = moderate, 2 = low, and 1 = not a priority. The study found 17 topics (38%) having moderate to high priority with a mean > 3.0, eight (32%) topics having low priority with a mean of < 3.0 but > 2.0, and none of the topics were rated not a priority. All topics had a SD ≤ 1.0 confirming a high level of agreement among agricultural

education teachers, giving a basis for developing a basic meat science curriculum for secondary agricultural education.

Introduction

As we venture into the 21st century, the need has arisen for Food Safety and Preparation Education. According to Rasmussen (1989) in 1850, 11,680,000 farm residents made up 50 percent of the population and 64 percent of the labor force (p. 20). In 1918, Secretary of Agriculture David F. Houston reported on the first year's operation of the Smith-Leaver Act. He stated that "women county agents" had worked on topics related to the physical well-being of families - home conveniences, eradication of flies and mosquitoes, proper preparation of food, care of poultry, and marketing of eggs. Approximately 50,000 homes had been visited, and those families had been given helpful suggestions. Six thousand farm women had presented special demonstrations in home improvements to fellow homemakers (p. 154). As we grew through the 20th century, we had a significant societal change in the family structure. More women wanted to and were required to work outside the home to help maintain fiscal responsibility. This contributed to a generation of people who are uneducated about home economics, food safety, and basic survival techniques (p. 155). Without strong home instruction in food safety and preparation, it is necessary for instruction to occur at the secondary school level.

History of American Agriculture: Agricultural Education & Extension lists several events that contributed to the development of agricultural education: The Morrill Acts of 1862 and 1890 were the first major acts of legislation to address the problem of

societal difference in education with the establishment of land grant institutions. With passing of the Smith-Hughes Act of 1917, vocational education changed significantly. This allowed federal money to go into state coffers, allowing the average individual to attend institutes of higher learning, previously only available to the elite of society. As we continued through the 20th century, several other acts of legislation were passed to benefit vocational education. These acts included the George-Dean Act of 1934, the National Defense Education Act of 1958, the Vocational Education Act of 1963, and the Carl D. Perkins Vocational Education Act of 1984.

The George-Dean Act of 1934 supplemented the areas of agriculture, home economics, trade, and industrial education. The National Defense Education Act of 1958 responded to the launching of the Russian satellite Sputnik. This event put current technical and scientific education under the microscope which resulted in a miserable failure. Congress was appalled at the results and passed legislation addressing the problem. The Vocational Education Act of 1963, also known as the Perkins-Morse bill, affirmed the federal government's commitment to vocational education as an essential part of the common welfare and defense of the country, giving technical and industrial education a needed economic boost. The Vocational Education Amendments of 1967 basically cancelled all previous legislation except the Smith-Hughes Act, which was retained as the first legislation for vocational education at the secondary level. The Carl D. Perkins Vocational Education Act of 1984 showed a philosophical change in Congress. The importance of vocational educational was realized by Congress with the administration handled at the local level (http://www.agclassroom.org/gan/timeline/ag_ed.htm.)

Hewitt (2006) stated that, concerning schools and schooling, there are two familiar contemporary examples. The report of the National Commission on excellence in Education of 1983, *A Nation at Risk,* initiated a national school reform movement that took different forms depending on how political parties and interest groups coalesced on particular aspects of the report. The legacy of that report, the impetus to and emphasis on reform, continues today. The importance of the report was not its effect on direct policy making but promoting different approaches to reform rather than using the governing apparatus of the state and the law.

That changed with the most recent reform initiative, the No Child Left Behind (NCLB) Act of 2001, signed into law in 2002. This act is the latest reincarnation of the Elementary and Secondary Education Act dating from the 1960s. The NCLB Act is a comprehensive accountability program based on extensive testing and increased financial support for schools meeting particular mandates such as developing curriculum standards, establishing comparative student performance levels across states, and assuring teacher quality in the areas of curriculum expertise. Reform, standards, associated coats, and the NCLB Act are major educational policy issues with important curriculum implications. The importance is the shift from policy initiatives resulting from reports and reformers to direct policy making by law (pp. 54-55).

Background for this Study

Vocational education needs have changed significantly over the 20th century with the current migration of young people off the farms. Therefore, a need has arisen for the development of educational techniques in the curriculum of basic meat science. Meat

science has grown extensively in the area of technology during the 20th century. The food science industry is a billion dollar a year industry. While several two-year institutions, four-year colleges and universities offer meat science courses and degrees, this is a new concept at the secondary school level (Stuska, 1993). According to Rasmussen (1989) changes of the 20th century, developed the need for changes in agricultural education. Farmers need more technical education to fill the agricultural needs of the 21st century. The farm labor force has decreased significantly and family farms have given away to corporate farms. Children of farmers are moving from rural to urban areas. With the constant change in agricultural education, we need to have in place a more effectively trained workforce for the high tech agriculture industry of today. This educational groundwork will need to start at the secondary school level (pp. 3-4). Currently there is not a nationally recognized basic meat science curriculum; however, several states do have a basic meat science curriculum.

CDC reports weekly of microbial outbreaks in foods and how this affects the safety of the general public:

> CDC's Outbreak Net Team conducted a multi-state case-control study in collaboration with health authorities in Ohio and Michigan to epidemiologically (the branch of medical science concerned with the occurrence and control of disease in populations) examine exposures that might be related to illness. The data indicate a significant association between illness and eating ground beef purchased at one of several Kroger® stores in Michigan and Ohio. CDC has provided these results to USDA-FSIS and public health agencies in Michigan and Ohio (retrieved 25 Aug 2008) http://www.cdc.gov/ecoli/june2008outbreak/index_071608.html.

Problem Statement

In today's world, concern with food safety is an everyday issue and occurrence. Thus, development and evaluation of basic meat science curriculum standards at the secondary agricultural school level are essential. Consideration of sanitation, preparation, carcass handling, meat processing, meat fabrication (cutting), and carcass harvesting are essential and need to be validated in a basic meat science curriculum.

Purpose and Objectives

The purpose of this study is to develop a list of meat science topics and standards for a basic meat science curriculum in secondary agricultural education using Expert and Delphi panels validated by agricultural education teachers. The expert panel was made up of meat science faculty. The Delphi panel participants were selected from industry and academia. Teacher representatives were current agricultural education teachers from six southern and Mid-Atlantic states—Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

The following objectives will be established in conducting this research:

1. develop basic meat science topics for a basic meat science curriculum at the secondary agricultural education school level,
2. develop a list of standards under each topic to validate a basic meat science curriculum at the secondary agricultural school level,
3. have standards validated by current agricultural education teachers who teach animal science and/or animal production courses.

Materials and Methods

Instrumentation

This study used an expert panel to develop a list of basic meat science topics. Experts were selected for this study based on meeting the criteria of:

1. teaching meat science courses at the college level,
2. coaching meat/livestock judging teams, and
3. participating on a collegiate meats/livestock judging team.

The following were selected and agreed to serve on the expert panel. The Expert panel consisted of Dr. George Skelley, Professor Emeritus Meat Science, Animal and Veterinary Sciences, Clemson University, Dr. Melvin Hunt, meat science faculty at Kansas State University assisted by other meat science faculty at Kansas State University. The expert panel combined basic meat science course syllabi from introductory meat science courses from the following universities: Auburn University, The University of Arkansas, Clemson University, The University of Florida, The University of Georgia, Kansas State University, The University of Minnesota, Montana State University, The Ohio State University, Oklahoma State University, Oregon State University, South Dakota State University, The University of Tennessee, Texas A&M University, The University of West Virginia, and The University of Wyoming into a general outline of basic meat science topics. The syllabi were obtained from university web sites or personal contacts.

A validation panel made up of Drs. Thomas R. Dobbins, Donnie R. King, Phillip M. Fravel, and K. Dale Layfield, agricultural education faculty at Clemson University was formed to validate the different aspects of the study.

A Delphi panel was used to develop a basic meat science topics and standards. Standards were validated by secondary school agricultural education teachers. The teachers were asked to rate 100 basic meat science curriculum standards based on a range from "Not a Priority" to "High Priority".

A modified Delphi research technique was used in this study to develop a list of basic meat science curriculum topics with standards under each topic for secondary agricultural education. Delphi is a proven method used to bring many opinions to a consensus. Custer, Scarcella, and Stewart (1999) noted:

> The modified Delphi Technique is similar to the full Delphi in terms of procedure (i.e., a series of rounds with selected experts) and intent (i.e., to predict future events and to arrive at consensus). The major modification consists of beginning the process with a set of carefully selected items. These pre-selected items may be drawn from various sources including related competency profiles, synthesized reviews of the literature, and interviews with selected content experts. (JVET, 1999, 15(2), p. 2).

Two rounds were used to develop the basic meat science curriculum topics with standards for each topic. Upon the completion of Round 2, the Delphi panel established the survey of standards for a basic meat science curriculum in secondary agricultural education. Using a Web-based survey the standards were ranked on a four-point Likert-type scale—Not a Priority, Low Priority, Moderate Priority, and High Priority. Prior to final analysis of the data, the Likert-type scale was coded to numbers: 1 = Not a Priority, 2 = Low Priority, 3 = Moderate Priority, and 4 = High Priority.

Population

Delphi Panel

Guidelines on the specific number of experts required on a Delphi panel are not available. In a study by Sutphin (1981), seven experts were used, while other studies have used up to 100 experts. The type of study and the expense of having a large number of experts will determine the number of experts needed (Dobbins, 1999). The expert panel needs to have the expertise to achieve the necessary results and be large enough to accomplish these goals (Sutphin, 1981). According to Huber and Delbecq (1972, p. 172), "strategic benefits are obtained by having at least five judges [experts], but the benefits of increasing beyond ten judges is modest." For this study, eight panelists were used, each bringing certain areas of expertise to the study. An expert is an individual having special skills or knowledge derived from training or experience (Gove, 1981). The expert and Delphi panels should have the following qualifications:

1. a strong teaching background at the university and/or secondary school level,
2. a strong background in meat science,
3. teach meat classes and/or work with meat judging teams.

The Delphi Panel was selected from personal contacts from the meat industry, meat science academia and top ten coaches of National Meat Evaluation Career Development Events (CDE) from 2000 to 2005. Prospective participants were contacted by phone and/or e-mail and asked to assist with the development of a basic meat science curriculum instrument, including determining topics and standards under each topic. Four from the meat industry and meat science academia agreed to assist with the study.

They were: Thomas Powell, Executive Director, American Meat Science Association AMSA); Dwight Loveday, Faculty, University of Tennessee; Fred Pohlman, Faculty, University of Arkansas; and George Skelley, Professor Emeritus, Clemson University. CDE coaches were selected from coaches of the top 10 FFA National Meats CDE teams from 2000 to 2005. The researcher, under the guidance of Dr. Thomas Dobbins, drafted a letter that was sent to coaches of the top 10 FFA National Meats CDE teams from 2000 to 2005 asking for assistance in the development of the instrument. A total of 36 letters were mailed out asking for assistance with the study and to provide e-mail addresses. The e-mail addresses were used to expedite the exchange of information and reduce the cost of correspondence. Four responses were received stating willingness to assist and two of these were referrals.

The Delphi panel was made up of four experts from the meat industry and academia and four FFA National Meats CDE coaches. Each nominee was contacted by phone or e-mail to determine their availability and interest in being a part of this study. Of the initial nominees contacted, all agreed to participate in the study.

Agricultural Education Teachers

The population for this study was made up of agricultural education teachers from the following six states: Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia. The panel of agricultural education teachers was not a random selection, but a deliberate selection of teachers who teach animal science, animal production courses and participate in career development events (CDE). The National FFA defines a CDE as: the answer to "when will I ever use this in the real world?" Since 1928, FFA

has worked to create CDEs that demonstrate the meaningful connections between classroom instruction and real-life scenarios. CDEs build on what is learned in agriculture classes and the FFA. The events are designed to help prepare students for careers in agriculture. Classroom instruction comes alive as students demonstrate their skills in a competitive setting. CDEs test the ability of individuals and teams in 23 major areas of agriculture instruction. A meat evaluation contest is an example of a CDE (http://www.ffa.org/index.cfm?method=c_programs).

Collection of Data

The procedures associated with data collection in this study included development of a standards survey for a basic meat science curriculum by expert and Delphi panels to be validated by agricultural education teachers. Follow-up procedures included preparation of and mailings to (e-mail included) the expert and Delphi panels. A Web-based survey was used to seek agricultural education teachers input on the list of standards. The online survey was deployed using a special tool in Blackboard (version 6.5). Blackboard is a course management software program that Clemson University uses for class instruction and additional programming was used to provide additional utilities. Blackboard includes a function titled "Organizations" in which Clemson University Computing and Information Technology (CCIT) staff developed a survey tool. The tool allows the researcher to insert questions and choose a mode of response from the population. The survey included an essay-format question that requested the FFA Chapter number of each agricultural education teacher's corresponding school. The chapter number was used to identify the teacher in order to follow up with non-

respondents and determine which state they were from. In addition, the 100 questions that represented the meat science curriculum standards were included in the survey. A dropdown menu was used for the respondents to answer their opinion on each of the meat science curriculum standards. The response choices were "high priority," "moderate priority," "low priority" and "not a priority." A copy of the Web-based survey can be seen under Appendix U. Survey data were downloaded into an Excel® spread sheet, allowing the researcher to code the literary responses into numerical responses for downloading into SAS® for final data analysis.

An e-mail message (Appendix L) was sent to all agricultural education teachers in the population area asking if they would participate in this study to validate the list of standards developed by expert and Delphi panels. They were also asked to name their preference of an online (Appendix U) or written (Appendix P) survey. Those who indicated they would participate and had requested an online survey were sent the URL link to the Web-based survey. One requested a written survey which was mailed with instructions and responses were added into data set. All participants were asked to validate the standards, on the importance to a basic meat science curriculum. They were not required to be able to teach the standards. The different levels of expertise in meat science were not taken into consideration. The e-mail message contained the deadline date for completion of the survey and additional information the agricultural education teachers would need to complete the survey. The participants were told that the survey would take 45 to 60 minutes to complete. Once the survey was submitted, the teacher could not make changes.

Round 1

The Delphi Panel was asked to add or remove any topic and return the outline to the researcher (Appendix A). The researcher compiled returned outlines and generated a consensus outline (Appendix G) from panel input and returned to the Delphi panel for final approval. The researcher took the consensus outline and added a Likert-type scale. The Likert-type scale, using 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree, was added to each topic. An area below each topic was added for comments.

Round 2

The topic outline (Appendix G) was e-mailed (Appendix E) to the Delphi panel with instructions (Appendix F) to add comments under each topic in the outline. In addition, the panel was instructed to rate each topic on the Likert-type scale and return the instrument to researcher. The researcher compiled returned outlines into a uniform instrument with all returned comments listed under each topic (Appendix I). The researcher calculated the means and standard deviations on each topic (Appendix J). Any topic with a mean of < 2.5 and standard deviation were removed from the study (Appendix S).

The comments left in the study were then separated out under each topic and a Likert-type scale— Not a Priority, Low Priority, Moderate Priority, and High Priority — was added to each standard (the comments will be referred to as educational standards). With 136 standards, Dr. Skelley further reduced standards to 100 by removing duplicate or similar standards and those that were not clear (Appendix R). One hundred standards were selected to minimize the time needed by the agricultural education teachers to com-

plete the survey to increase the response rate. The topics were removed for clarity and any possible bias. This completed the instrument and the survey was ready to be sent to agricultural education teachers. Topics were reinstated to the data set for final analysis.

Deployment of the Survey

E-mail letters were sent to state leaders in Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia asking for assistance with the names and e-mail addresses of agricultural education teachers who teach animal science and/or animal production in their state and who would be willing to assist with the dissertation research.

Florida and Georgia sent complete lists of all teachers and classes taught. The researcher sorted out teachers that met the study criteria of teachers who teach animal science and/or animal production classes. North Carolina, South Carolina and Virginia sent specific lists of teachers who met study criteria. Tennessee sent out the survey through the state office.

An e-mail message was sent to agricultural education teachers in Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia through their state leaders asking for assistance in completing the survey and their preference of a Web-based or written survey. One requested a written survey which was mailed and the responses were added to final data set. All other responses used the Web-based survey. The agricultural education teachers were asked to rate each standard using a drop down menu. Three e-mail reminders were sent to non-responders at three- to four-week intervals from launch of survey.

Treatment of Data

Results from expert and Delphi panelists were compiled to establish a list of standards to be validated by the agricultural education teachers. The agricultural education teachers ranked each standard on a four-point Likert-type scale—Not a Priority, Low Priority, Moderate Priority, and High priority. Teacher responses to survey were coded to number representation of 1-4 respectively before analysis. Using SAS®, means and standard deviations were calculated on each standard. Topic means and standard deviations were calculated from the standard means and standard deviations under each topic.

Deployment of the Survey Instrument

State Leaders from Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia aided in this study by providing information on their teachers who teach animal science and/or animal production. The researcher selected 81 that met the study criteria (Table 1) and sent the survey's URL via e-mail with instructions on how to complete the survey. One requested a paper survey response. This response was added to the final data set. Three e-mail reminders were sent to non-responders at three- to four-week intervals from the launch of the survey.

Agricultural education teachers were asked to rate each standard using a drop-down menu. The selections were Not a Priority, Low Priority, Moderate Priority, and High Priority. A Likert-type scale was converted to numbers using 1 = Not a Priority,

Table 1. Data on Distribution and Responses of Surveys: n = 52

State	Number of Surveys Sent	Number of Responses	Percentage Return
Florida	20	18	90
Georgia	15	2	13
North Carolina	11	4	36
South Carolina	16	16	100
Tennessee	15	11	73
Virginia	4	1	25
Totals	81	52	64

2 = Low Priority, 3 = Moderate Priority, and 4 = High Priority. Data were analyzed using means and standard deviation. Standards with a mean of < 2.5 and a standard deviation of > 1.0 were removed before final topic analysis.

Results of the Agricultural Education Teachers' Survey

Eighty-one e-mails were sent to agricultural education teachers in six southern and Mid-Atlantic States based on study criteria. The e-mail message contained the following request for participation, the survey's URL, and instructions explaining how to answer the on-line survey. Based on study criteria, the number of teachers surveyed varied due to the number of teachers that teach animal science and/or animal production from state to state.

Florida and Georgia were selected from the complete list of agriculture education teachers and courses taught. The researcher selected 20 from Florida with a response rate

of 18 (90%) and 15 from Georgia with a response rate of 2 (13%). The Tennessee survey was sent through the State Leader. Fifteen were sent with a return rate of 11 (73%). Eleven surveys were sent to North Carolina; four were returned for a response rate of (36%). Sixteen surveys were sent to South Carolina; 16 were returned with a response rate of (100%). Four surveys were sent to Virginia with one returned for a return rate of (25%). A total of 81 surveys were sent with 52 responses for a total return rate of (64%).

The agricultural education teachers that responded to the survey rated 100 basic meat science standards using a drop down menu of Not a Priority, Low Priority, Moderate Priority, and High Priority. Excel® allowed the researcher to code the 1 = Not a Priority, 2 = Low Priority, 3 = Moderate Priority, and 4 = High Priority for final analysis of the data. The topics were added back into the data set for analysis. The analyses on the topics are presented in Table 2. Means and standard deviations were calculated using the means and standard deviations of the basic meat science standards/ competencies under each topic (Table 3).

The study found 17 topics (68%) rated moderate to high priority with a mean greater than 3.0 and eight (32%) topics in the low priority with a mean of less than 3.0, but greater than 2.0 and no topics were rated not a priority. All topics had a SD < 1.0 confirming a high level of agreement among Agricultural education teachers.

Discussion of Findings

The Delphi panel developed 25 Basic Meat Science topics and 100 Basic Meat Science standards through the use of a modified Delphi technique starting with a college introductory meat science syllabi. This instrument survey was then sent to agriculture

Table 2. Mean and Standard Deviation for Basic Meat Science Topics

Topic	Mean	Standard Deviation
Visit to a Supermarket	3.67	0.49
Retail Cuts	3.59	0.62
Harvest	3.47	0.57
Sanitation, SOP, GMP	3.44	0.57
Microbiology, Meat as a Culture	3.40	0.61
Quality Grade	3.37	0.62
Color	3.35	0.65
Yield Grade	3.29	0.65
Class Placing of Meat	3.27	0.69
Fresh Meat Properties	3.23	0.60
Grading of Meat	3.21	0.83
Identification of Meat	3.20	0.68
Meat as a Part of Culture	3.17	0.52
Food Groups	3.15	0.59
Inedible By-products	3.14	0.66
Fabrication	3.13	0.67
Inspection	3.10	0.62
Hazard Analysis of Critical Control Points (HACCP)	2.96	0.73
Nutrition of Meat	2.94	0.70
Edible By-products	2.94	0.66
History	2.92	0.63
Report of Survey to Class	2.90	0.73
Value Added Processing	2.82	0.63
Sausage	2.78	0.75
Curing and Smoking	2.77	0.71

4 = High Priority, 3 = Moderate Priority, 2 = Low Priority, and 1 = Not a Priority.

*Line divides table between high, moderate priority and low, not a priority.

See Appendix T for definitions and explanation of topics in Table 2.

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education

		Mean	Standard Deviation
History		2.92	0.63
	The student will be able to:		
1	know the historical events that changed or modified the industry (refrigeration and “The Jungle");	2.78	0.82
2	know the history of the meat packing industry, noting the changes from the northeastern states to the central plains states (refrigeration, railroads, interstate highway systems, disassembly of carcass from Henry Ford assembly);	2.83	0.81
3	show how American History and Meat Science are closely related;	2.87	0.84
4	observe the how and why the meat industry has evolved, including technological innovations and changes in processing centers.	3.21	0.75
Meat as a Part of Culture		3.17	0.52
	The student will be able to:		
5	observe the relative changes in consumer consumption of meat products over the past 100 years;	3.44	0.67
6	know what caused these changes and the history of meat consumption in various cultures around the world;	3.21	0.72
7	recognize that meat helps determine the culture of the people;	2.83	0.79
8	know what drives meat consumption as related to culture and how the industry fits or might fit in the future.	3.19	0.63
Visit to the Supermarket		3.67	0.49
	The student will be able to:		
10	identify retail cuts in meat counter and be able to determine what cut you want to buy;	3.67	0.65
11	Identify products by label, species, cuts (wholesale and retail), meat label components, case ready products, type of packaging;	3.65	0.56
12	Begin to know the movement of meat from farm to table.	3.67	0.55
Report of Survey to Class		2.90	0.73
	The student will be able to:		
13	discuss findings of supermarket survey;	2.59	0.82
14	report on findings of supermarket survey, research a topic in new technology/research in meat science for tenderness, juiciness, and flavor, ready to eat meats, heat and serve, and/or value added meat products (flat-iron steak);	2.98	0.88
15	relate their ideas from supermarket study of meat and the consumer.	2.90	0.87
16	process what they have learned from supermarket survey and communicate their findings to others.	3.20	0.80

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Harvest		3.47	0.57
	The student will be able to:		
17	know all factors affecting the animal body pre-harvest and how these factors affect the final product;	3.35	0.74
18	observe how an animal is slaughtered and what parts are removed from the animal during harvest;	3.57	0.67
19	realize the science and art of meat animal harvest;	3.92	0.70
20	know general terms of how animals are harvested and what factors relate to meat quality.	3.57	0.61
Color		3.35	0.65
	The student will be able to:		
21	explain the physiological changes in muscle color and the factors that affect these changes;	3.25	0.74
22	describe the differences in color from beef, lamb, and pork--both smoked and fresh--and also learn what PSE (pale, soft, and exudative) meat looks like as well as old and youthful;	3.31	0.81
23	identify normal, superior and inferior color of meat, as it deals with retail identification, freshness, and quality;	3.50	0.80
24	recognize and know changes in meat color;	3.37	0.74
25	know how color is developed and why color is important.	3.35	0.74
Fresh Meat Properties		3.23	0.60
	The student will be able to:		
26	know the properties of fresh meat post-mortem and how these properties affect the final fresh meat product;	3.23	0.73
27	identify those properties that will be readily accepted or rejected by consumers;	3.52	0.67
28	know the importance of water holding capacity (WHC);	2.81	0.79
29	know what factors influence fresh meat properties and how this relates to meat quality characteristics.	3.27	0.77
Fabrication		3.13	0.67
	The student will be able to:		
30	cut carcasses into main wholesale cuts distinguishing between the high merchandizing valued middle-meats and other cuts;	3.42	0.82
31	observe fabrication at a local processing plant;	3.06	0.92
32	know the need for boxed product to fill large orders of special cuts;	2.79	0.82
33	identify where retail cuts are found and validate carcass classes and wholesale cuts to determine level of quality.	3.56	0.73

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Retail Cuts		3.59	0.62
	The student will be able to:		
34	identify meat cuts by species and name the wholesale cuts, including smoked products;	3.62	0.63
35	identify common retail cuts of beef, pork, and lamb and validate classes of retail cuts from a consumer's perspective;	3.71	0.64
36	begin to recognize individual retail cuts from the different wholesale cuts of a specific species;	3.49	0.73
37	identify general retail cuts, anatomy of muscle and bone, and where cuts originate.	3.44	0.80
Quality Grade		3.38	0.62
	The student will be able to:		
38	determine the age and marbling scores of swinging beef carcasses and correct quality grade;	3.21	0.78
39	know beef USDA quality grades, determine inferior quality of pork and lamb and the use of this information to validate classes of carcasses, wholesale and retail cuts;	3.50	0.67
40	become familiar with these grades and their usefulness in pricing and acceptability of the product;	3.37	0.71
41	determine quality grades, factors involved, what influences them, and why they are important.	3.37	0.74
Yield Grade		3.29	0.65
	The student will be able to:		
42	determine Preliminary Yield Grade (PYG);	3.12	0.81
43	determine USDA beef yield grade, determine trimness and muscling of pork and lamb and use this information in the evaluation of carcass classes, wholesale and retail cuts;	3.35	0.71
44	become familiar with the grades and their usefulness in pricing and acceptability of product at the wholesale level;	3.33	0.68
45	determine yield grades, what influences them, and how to improve cutability.	3.33	0.74
Sanitation, SOP, GMP		3.44	0.57
	The student will be able to:		
46	demonstrate the relative importance of sanitation in a meat facility, relay the importance of standard operating procedures (SOP)) for daily sanitation operations and inspection;	3.38	0.87
47	know the proper cooking temperatures for meat;	3.39	0.78
48	identify safe and unsafe sanitation practices;	3.63	0.60
49	use sanitation principles in combination with meat micro to appreciate a clean environment.	3.38	0.72

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Microbiology, Meat as a Culture		3.40	0.61
	The student will be able to:		
50	know the importance of sanitation and environment on various types of microorganisms and how the condition of the meat facility affects bacterial growth;	3.41	0.70
51	know factors that affect microorganism contamination and growth;	3.35	0.76
52	realize the potential of any food hazard and ways to control;	3.50	0.67
53	know the microbiological threat to food safety of meat, what factors influence food safety, and how to improve.	3.29	0.82
Inspection		3.10	0.62
	The student will be able to:		
54	know the importance of USDA inspection in the US, convey why the Meat Inspection ACT was passed;	3.29	0.75
56	discuss parts of a carcass a meat inspector will look at to determine wholesomeness;	3.08	0.88
57	know how meat inspection has evolved and relates to a safe and wholesome meat supply.	3.13	0.82
Hazard Analysis of Critical Control Points (HACCP)		2.96	0.73
	The student will be able to:		
59	know the principles of HACCP, but not develop a plan;	2.63	0.93
60	note that all personnel involved in the meat chain are indeed responsible for the safety of the food on the consumer's table;	3.35	0.81
61	know what HACCP is and what's involved in creating a HACCP plan without the development of an individual plan.	2.81	0.95
Food Groups		3.15	0.59
	The student will be able to:		
62	use the newest food pyramid to establish a healthy diet with all essential nutrients;	3.10	0.77
63	identify what the major food groups are and why meat is important to an individual's diet;	3.25	0.76
64	know the importance of meat in the human food supply;	3.48	0.74
65	know what constitutes the food groups and how to follow the new food guide pyramid.	3.08	0.88

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Nutrition of Meat		2.94	0.70
	The student will be able to:		
66	recite the relative composition of meat products, including protein, fat, minerals, vitamins, and any necessary elements that are not provided by other food stuff;	2.92	0.82
67	discuss the nutrient density of meat and identify the major vitamins and minerals found in meat;	2.87	0.82
68	know the vast amount of nutrients that are in the hamburger and other meat products;	2.88	0.88
69	know the nutrient composition of meat and how meat fits into a wholesome healthy diet.	2.98	0.78
Curing and Smoking		2.77	0.71
	The student will be able to:		
70	know the chemical properties and the changes that occur in smoked and cured products;	2.60	0.87
71	identify and discuss various chemicals and why they are used;	2.62	0.91
72	know the basic principles of curing and smoking;	2.90	0.85
73	know the changes that occur during the process of curing and smoking.	2.87	0.89
Sausage		2.78	0.75
	The student will be able to:		
74	differentiate between the origins of sausages from their names, observe the different ingredients used in various types of sausage, and distinguish between the different types of casing;	2.63	0.84
75	discuss why we grind, smoke, and cure meat;	2.92	0.86
76	become acquainted with the most important and largest groups of meat compounds;	2.71	0.76
77	know the major product forms, production process for sausage, an appreciation for casing types and process techniques used in sausage manufacturing.	2.61	0.87
Value Added Processing		2.83	0.63
	The student will be able to:		
78	know the importance of research to find or add value to products that were once considered of low value and to find niche markets;	2.72	0.88
79	identify and discuss ways to add value to carcasses and primal cuts by processing (ex. Flat-Iron steak);	3.04	0.71
80	know the importance of continued studies and research to obtain new products and new systems of selling meat products;	2.88	0.73
81	know the major processes involved with adding value to whole muscle and comminuted meat.	2.52	0.75

Table 3. Means and Standard Deviations for Meat Science Standards/Competencies for Secondary Agricultural Education (Continued)

		Mean	Standard Deviation
Edible By-products		2.94	0.66
	The student will be able to:		
82	learn what variety meats are from the three species;	3.21	0.82
83	identify various edible by-products by sight and discuss their uses;	3.08	0.86
84	see the great diversity that edible by-products bring to meat food groups;	2.94	0.84
85	know the harvesting process and uses for animal by-products.	3.04	0.79
Inedible By-products		3.14	0.66
	The student will be able to:		
86	list and explain the various type of medical, health, beauty, aesthetic, and other products that come as by-products of the meat industry;	3.31	0.70
87	discuss the uses of inedible by-products;	3.15	0.83
88	become aware of the importance of inedible by-products;	3.10	0.85
89	know the harvest, processing, and uses for major inedible by-products.	2.82	0.79
Identification of Meat		3.20	0.68
	The student will be able to:		
90	identify and differentiate various species, wholesale, and retail cuts of meat--fresh, smoked or cured;	3.25	0.88
91	identify a variety of meats that come from different species and relate the importance of these cuts in terms of merchandizing;	3.21	0.85
92	identify retail cuts by species, primal cut and retail names of beef, pork, and lamb;	3.52	0.73
93	Determine cut identification, primal cut and species of origin for meat cuts.	3.42	0.75
Grading of Meat		3.21	0.83
	The student will be able to:		
94	calculate USDA quality and yield grades of beef carcasses and know the concepts behind calculated muscling in pork, US grades, and how to calculate USDA quality and yield lamb carcasses;	3.15	1.00
95	calculate beef USDA quality and yield grade to within a third of a grade;	3.00	0.98
96	determine quality and yield grades for beef carcasses.	3.29	0.85
Class Placing of Meat		3.27	0.69
	The student will be able to:		
97	know the placing criteria for the different cuts in the contest;	3.17	0.92
98	validate beef, pork, and lamb carcasses, primal and retail cuts;	3.35	0.79
99	know consumer decision making;	3.30	0.74
100	develop problem solving skills by determining value of meat carcass or cut's classes.	3.25	0.95

education teachers in six southern and mid-Atlantic states: Georgia, Florida, North Carolina, South Carolina, Tennessee, and Virginia. Grand mean and standard deviation for each basic meat science topic were calculated using the basic meat science standards means and standard deviations under each topic. Topics were ranked in descending order by mean. The study found 17 topics (68%) in the moderate to high priority with a mean > 3.0, eight (32%) topics in the low priority with a mean of < 3.0 but > 2.0, and none of the topics were rated not a priority. All topics had a SD < 1.0 confirming a high level of agreement among agricultural education teachers.

Development of basic meat science topics and standards by expert and Delphi panels and validated by agricultural education teachers gives basis to the development of a basic meat science curriculum for secondary agricultural education. This ranking allows for an outline of the topics in the moderate to high priority and associated standards to start the development of a basic meat science curriculum. These topics include: visit to a supermarket, retail cuts, harvest, sanitation (SOP, GMP), microbiology, (meat as a culture), quality grade, color, yield grade, class placing of meat, fresh meat properties, grading of meat, identification of meat, meat as a part of culture, food groups, inedible by-products, fabrication, and inspection. Explanation of the topics can be found in Appendix T.

Conclusions and Recommendations

Based on the findings of the study, 17 topics (68%) ranked in the moderate to high priority category with a mean > 3.0, eight (32%) topics ranked in the low priority category with a mean of < 3.0 but > 2.0, and none of the topics were rated not a priority.

All topics had a SD < 1.0 confirming a high level of agreement among agricultural education teachers. There is a definite need for a basic meat science curriculum at the secondary agricultural education school level in the states included in this study, as all topics were rated at high, moderate, or low priority. None of the topics or standards were rated not a priority. As society changes with fewer and fewer full time homemakers to teach food safety, CDC reports weekly of microbial outbreaks in foods and how this affects the safety of the general public.

> CDC's Outbreak Net Team conducted a multi-state case-control study in collaboration with health authorities in Ohio and Michigan to epidemiologically (the branch of medical science concerned with the occurrence and control of disease in populations) examine exposures that might be related to illness. The data indicate a significant association between illness and eating ground beef purchased at one of several Kroger® stores in Michigan and Ohio. CDC has provided these results to USDA-FSIS and public health agencies in Michigan and Ohio (retrieved 25 Aug 2008).
> http://www.cdc.gov/ecoli/june2008outbreak/index_071608.html

So, must our education system change in the area of meat science? The meat and food industry continues to develop, with a variety of job opportunities. With established meat science programs at the collegiate level and the continuing expansion of the food industry, it's only logical to establish basic meat science programs at the secondary agricultural education level to become feeder programs in conjunction with culinary arts programs for higher education and the food industry giving students another path to employment and careers after completing high school.

The topics and standards developed by expert and Delphi panels and rated by the agricultural education teachers can be used in the development of a basic meat science

curriculum. The ranking will allow for discretion by agricultural education teachers when funds and time are limited to teach the more important topics and standards.

The modified Delphi technique was used in this study to develop the survey instrument. This technique provides a more effective method of allowing for exchange of opinions without face-to-face interaction. Starting with a topic outline reduces the number of rounds needed to develop the survey instrument with the use of e-mail as the means to exchange these opinions. This method reduced the cost to complete the study.

The online survey was deployed using a special tool in Blackboard (version 6.5). Blackboard is a course management software program that Clemson University uses for class instruction and additional programming was used to provide additional utilities. Blackboard includes a function titled "Organizations" in which Clemson University Computing and Information Technology (CCIT) staff developed a survey tool. The tool allows the researcher to insert questions and choose a mode of response from the population. The survey included an essay-format question that requested the FFA Chapter number of each agricultural education teacher's corresponding school. The chapter number was used to identify the teacher in order to follow up with non-respondents and determine which state they were from. This was question 1 on survey. Questions 2-101 were the meat science curriculum standards to be validated by the agricultural education teachers. A dropdown menu was used for the respondents to answer their opinion on each of the meat science curriculum standards. The response choices were "high priority," "moderate priority," "low priority" and "not a priority," allowing raw data collected to be dumped into a spreadsheet for analysis.

The recommendations listed in this section are based on the findings of the study.

1. The secondary agricultural education programs should consider the development of a national standardized basic meat science curriculum to address the needs of students, society and industry. The topics and standards developed and validated in this study could be used to develop a basic meat science curriculum.

2. Replication of this study should be conducted on a national level.

3. Agricultural education teacher education in the area of basic meat science is important. Workshops should be developed to assist agricultural education teachers with the necessary knowledge and techniques needed to teach basic meat science courses.

4. Basic meat science curriculum textbook and teaching materials should be developed based on the rank order results provided by the agricultural education teachers.

5. Study needs to be expanded to poultry CDE coaches. This study removed all poultry topics and standards. Delphi panel members were from livestock and meat background with out poultry experience.

Limitations of the Study

This was a regional study, which developed the topics and standards for a basic meat science curriculum for agricultural education programs in secondary schools. Study data were collected from expert and Delphi panels made up of experts in the field of meat science and agricultural education teachers. Certain inherent limitations occurred in the study and were taken under consideration at the conclusion of the study.

Possible limitations to the study include:

1. topics and standards may be subject to bias, as consideration of expert and Delphi panels' ability, accuracy, and objectivity of responses were not validated;

2. teachers had different levels of expertise when they validated the standards;

3. the study involved only six states thus limiting broader assumptions.

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APPENDICES

Appendix A

Major Topics of Basic Meat Science Curriculum

1. History of Meat Science
2. Supermarket Survey
3. Overview of Livestock and Meat Industry
4. Conversion of Muscle to Meat
    a. pH effect on rigor
    b. pre and post mortem effects
5. Meat and the Diet
6. Food Safety
    a. HACCP
    b. Inspection
    c. Microbes
    d. SOPS, GMP
7. Meat Curing and Smoking
8. Sausage Manufacturing
9. USDA Grades of Livestock
    a. Quality
    b. Yield
10. Fresh Meat Properties
11. Meat Preservation
12. By-Products
13. Fabrication
14. Harvest

Appendix B

Letter to Top Ten National Meat CDE Coaches 2000-2005

April 4, 2009

Bobby Rosenbusch
Florence High School
PO BOX 489
Florence , TX 76527

Dear Bobby Rosenbusch,

Hello, my name is John K. Duke. I'm a doctorial candidate in Career and Technical Education at Clemson University. My dissertation topic is to develop Meat Science curriculum standards for secondary education in South Carolina. I'm writing you to ask for your assistance. The study will synthesize 15-20 collage level introductory course syllabi in Meat Science and condense the major topics into one uniform set. This will then be sent to a set of experts form the Meat Industry and professors of Meat Science. They will be asked to add or delete any major topic and to add subtopics. When returned their suggestions will be incorporated into the topics and subtopics and returned to experts for final approval. Upon completion of this process the topics and subtopics will be sent to you to add the standards, (What the students should know after completion. of the topic) if you think that a topic /subtopic needs to be added or deleted please indicate in writing why you have made that suggestion. If you are willing to participate in my study please respond by e-mail jkduke@clemson.edu or to the address below.
Please respond by July 15.

Thank you very much for your time and consideration

John K. Duke

John K. Duke
%Dr. Thomas R. Dobbins
228 McAdams Hall
Clemson University
Clemson, SC
29634

Appendix C

Letter to Meat Academia and Industry Experts

To: jriemann@certifiedangusbeef.com, HHunt@oznet.ksu, hloveday@utk.edu,
Tpowell@meatscience.org
Subject: Dissertation
Cc: jkduke@CLEMSON.EDU, tdbbns@CLEMSON.EDU

In the development of the major topics in meat science the following syllabi were used from the following Universities: Auburn, Arkansas, Clemson, Florida, Georgia, Kansas St., Minnesota, Montana St., Ohio St., Oklahoma St, Oregon St, South Dakota St., Tennessee, Texas A&M, West Virginia, and Wyoming. Dr. Skelley was consulted on the Topics and we have developed a set of topics to be covered in a secondary education meat science curriculum. What I need you to do is to add or delete any topic and add subtopics. Please return by July 22, 2005. If any questions please ask. I can be reached at _____.

Thanks again for time and consideration.

Thanks John

Appendix D

Consolidated Meat Science Topics

A Study of Meat Science Topics
for Secondary Agriculture Education

Unit Topic Likert scale 1-4

1. Overview of Livestock And Meat Industry _____
    a. History-Suggestions for objectives:
        1. the student will be able to
    b. Meat as a part of culture-Suggestions for objectives:
        1. the student will be able to
    c. Meat and World Hunger-Suggestions for objectives:
        1. the student will be able to
2. Supermarket Survey _____
    a. Visit to supermarket-Suggestions for objectives:
        1. the student will be able to
    b. Report to class-Suggestions for objectives:
        1. the student will be able to
3. Muscle to Meat _____
    a. Harvest-Suggestions for objectives:
        1. the student will be able to
    b. Color-Suggestions for objectives:
        1. the student will be able to
    c. Fresh Meat Properties-Suggestions for objectives:
        1. the student will be able to
4. Fabrication _____
    a. Wholesale cute / Boxed-Suggestions for objectives:
        1. the student will be able to
    b. Retail cuts-Suggestions for objectives:
        1. the student will be able to

Unit Topic Likert scale 1-4

5. Grades of Livestock and Meat _____
    a. Quality-Suggestions for objectives:
        1. the student will be able to
    b. Yield-Suggestions for objectives:
        1 he student will be able to
6. Food Safety _____
    a. Sanitation, SOP, GMP-Suggestions for objectives:
        1. the student will be able to
    b. Microbiology, Meat as culture-Suggestions for objectives:
        1. the student will be able to
    c. Inspection-Suggestions for objectives:
        1. the student will be able to
    d. HACCP -Suggestions for objectives:
        1. the student will be able to
7. Meat and the Human Diet _____
    a. Food groups-Suggestions for objectives:
        1. the student will be able to
    b. Nutrition of Meat-Suggestions for objectives:
        1. the student will be able to
8. Meat Preservation _____
    a. Curing and Smoking-Suggestions for objectives:
        1. the student will be able to
    b. Sausage -Suggestions for objectives:
        1. the student will be able to
    c. Value added processing-Suggestions for objectives:
        1. the student will be able to

Unit Topic Likert scale 1-4

9. By-Products _____

    a. Edible-Suggestions for objectives:

        1. the student will be able to

    b. Inedible-Suggestions for objectives:

        1. the student will be able to

10. Overview of FFA Career Development Events _____

    a. Meats

        i. Written-Suggestions for objectives:

            1. the student will be able to

        ii. ID-Suggestions for objectives:

            1. the student will be able to

        iii. Grading-Suggestions for objectives:

            1. the student will be able to

        iv. Class placing-Suggestions for objectives:

            1. the student will be able to

c. Poultry

        i. Class Placing-Suggestions for objectives:

            1. the student will be able to

        ii. Quality grades-Suggestions for objectives:

            1. the student will be able to

        iii Eggs-Suggestions for objectives:

            1. the student will be able to

        iv. Further procession-Suggestions for objectives:

            1. the student will be able to

Appendix E

E-mail Sent to Delphi Panel with Appendix G Attached

-----Original Message-----
From: John K. Duke [mailto:jkduke@CLEMSON.EDU]
Sent: Monday, February 13, 2006 5:35 PM
To: Tjames@waltoncsd.stier.org; clint.alexander@gcccks.edu; mheddlesten@usd507.org; cshimme@esu11.org; aclaxton@hcbe.net; ray.pieniazek@fc.ecisd.net; butchbowhunts@hotmail.com; Rick.Vannett@sendit.nodak.edu; tdbbns@CLEMSON.EDU; jkduke@CLEMSON.EDU
Subject: Help with Dissertation

Thanks Again for you're help. attached you will find two files one is the instrument survey to fill out and the other is how to fill out the instrument survey. If possible please return by 15mar06. as in the directions feel free to add any materials I may of over looked. Feel free to forward to any one else you feel will help and has coached meat's teams or taught meat's.

Thanks Again

John

Appendix F

Instructions for Appendix G

Instrument Directions:

Hello and once again thank you for your help. Attached you will find the research instrument that needs your input. At each topic and subtopic is a Likert scale from 1 SD - 4 SA to be marked. After each subtopic is an area for comments and/or objectives. At this point place curser after comments, click and your ready to type; the area and lines will continue as long as you're typing. You can also move from question to question and back. The area will continue as long as you do. Feel free to add any material as attachments or mail to:

John K. Duke
%Thomas R. Dobbins, PhD.
Associate Professor and Coordinator
Agricultural Education Program

If you have any questions feel free to call Dr. Dobbins or me.

Appendix G

Survey Instrument

A Study of Meat Science Topics for Secondary Agriculture Education

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

1 SD 2 D 3 A 4 SA

Overview of Livestock And Meat Industry 1☐ 2☐ 3☐ 4☐

a. History- 1☐ 2☐ 3☐ 4☐

2. the student will be able to

Comments: _____

_____

b. Meat as a part of culture 1☐ 2☐ 3☐ 4☐

3. the student will be able to

Comments: _____ _____

_____

c. Meat and World Hunger 1☐ 2☐ 3☐ 4☐

4. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

2. Supermarket Survey 1☐ 2☐ 3☐ 4☐

a. Visit to supermarket 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Report to class 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

3. Muscle to Meat 1☐ 2☐ 3☐ 4☐

a. Harvest 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Color 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

c. Fresh Meat Properties 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

4. Fabrication. 1☐ 2☐ 3☐ 4☐

a. Wholesale cuts / Boxed 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Retail cuts 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

5. Grades of Livestock and Meat 1☐ 2☐ 3☐ 4☐

a. Quality 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Yield 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

6. Food Safety 1☐ 2☐ 3☐ 4☐

a. Sanitation, SOP,GMP 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Microbiology, Meat as a culture 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

c. Inspection 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

d. HACCP 1☐ 2☐ 3☐ 4☐

1 .the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

7. Meat and the Human Diet 1☐ 2☐ 3☐ 4☐

a. Food Groups 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Nutrition of Meat 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

8. Meat Preservation 1☐ 2☐ 3☐ 4☐

a. Curing and Smoking 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Sausage 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

c. Value added processing 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

9. By-Products 1☐ 2☐ 3☐ 4☐

a. Edible 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

b. Inedible 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

10. Overview of FFA Career Development Events 1☐ 2☐ 3☐ 4☐

a. Meats 1☐ 2☐ 3☐ 4☐

i. Written 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

ii. ID 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

iii. Grading 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

iv. Class Placing 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

b. Poultry 1☐ 2☐ 3☐ 4☐

i. Class Placing 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

ii. Quality grades 1☐ 2☐ 3☐ 4☐

1 .the student will be able to

Comments: _____ _____

_____

iii. Eggs 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

iv. Further processing 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: _____ _____

_____

Appendix H

E-mail Sent to State Leaders in Southeastern States

To: wkells@CLEMSON.EDU, jwilk@uga.edu, steven.gass@state.tn.us, gerald_barlowe@ncsu.edu, belinda.chason@fldoe.org, gseibel@VT.EDU, tdbbns@CLEMSON.EDU
Subject: Dissertation research help
Cc: jkduke@CLEMSON.EDU, tdbbns@CLEMSON.EDU

State Leaders,

I am John K. Duke an Agricultural Education Doctoral Candidate at Clemson University. I need help on my dissertation research. My research is the development of Meat Science objectives for secondary education in South Carolina; however the results will be available for state use if requested. I need the names and e-mail addresses of your teachers who provide instruction in the Animal Science area. I will send a letter asking for their help in filling out a short survey on meat science objectives with a space for their comments if warranted or needed. I will send the survey electronically or by mail if needed. If any questions please ask Dr. Dobbins or myself at 864-247-2038 or any of the contact points listed below. Thank you for your time and consideration.

Thanks John

Thomas R. Dobbins, PhD
Associate Professor and Coordinator
Agricultural Education Program

John K. Duke
Agricultural Education Doctoral Candidate

Appendix I

Study of Meat Science Topics for Secondary Agricultural Eudcation with Common/Objects Consolidated

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

	1 SD	**2 D**	**3 A**	**4 SA**
Overview of Livestock And Meat Industry	1☐	2☐	3☐	4☐
a. History-	1☐	2☐	3☐	4☐

5. the student will be able to

Comments: 1) Scientific names of major classes of livestock and where domesticated.(taught in chapter of domestation of livestock)CS 2) historical events that change or modified the industry(ex. refrigeration and the jungle)HDL 3) History of meat packing industry note changes from NE states to Central Plains (refrigeration, rail roads, interstate highways systems, disassembly of carcass from Henry Ford assembly.CA 4.) show American History and Meat Science are closely related.GCS.5)The history of the meat industry I believe is important. I believe it allows students to understand how it has evolved and why. This includes technological innovations, change in processing centers and why. Hopefully this will not only tell them where we've been, but more importantly where we went and where we are going in the future. (FP)

b. Meat as a part of culture	1☐	2☐	3☐	4☐

6. the student will be able to

Comments: 1) Observe the relative changes in consumer consumption of meat products over the past 100 years and what has caused these changes, know the history of meat consumption in various cultures around the world (or what they commonly view as sacred or what animals were used for), understand and contemplate the social status of consuming meat in the US or abroad, and understand the categories of meat products. (CA). 2 Recognized that meat helps determine the culture of a group of people. (GCS) 3.) Understand what drives meat consumption as related to culture and how the industry fits and might fit in the future.(FP)

c. Meat and World Hunger 1☐ 2☐ 3☐ 4☐

the student will be able to

Comments: 3.) Talk how most people don't have enough to eat. (CS 2.) Understand and relay the relative world population and note the bell-shaped curve (or Sigmoidal shaped curve) in world population from 2000 years ago to the present, note the relative ability of the world to feed itself.(CA) 3) understand the value of meat in any progress that can be realized in eliminating world hungry.(GCS) 4). Understand the link between socioeconomic drivers and consumption of meat in devolping and devoloped countries. Futhermore, this could also be linked to meat's role in a healthy diet and how it fits with alliviating world hunger.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

2. Supermarket Survey 1☐ 2☐ 3☐ 4☐

a. Visit to supermarket 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.) Students keep daily log of meat and meat cuts they consume, supermarket trip comes after retail cuts are known. (Butch) 2.) ID retail cuts in meat counter and be able to determine, what cut you want to buy. (CS) 3.) ID items available to consumer (HDL) 4.) ID products by label, species, Cuts wholesale and retail, meat labels components, case ready products, types of packaging. (CA). 5.) begin to understand the movement of meat from farm to table. (GCS) 6.) Understand how meat is packaged, prepared and marketed. Furthermore, students would also learn about technologies to improve self-life and salability and why these are important.(FP)

b. Report to class 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.) Oral reports in another section of AG I. (Butch) 2.) Discuss findings of supermarket survey. (CS) 3. Report on findings of supermarket survey, research a topic in new technology/research in meat science for tenderness, juiciness, flavor, ready to eat meats, heat and serve, and/or value added meat products.(Flat-Iron Steak) (CA) 4.) Relate their own ideas from a supermarket study of meat and the consumer. (GCS) 5.) This would be a valuable exercise to allow students to digest what they have learned and gives them the opportunity to communicate what they have learned.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

3. Muscle to Meat 1☐ 2☐ 3☐ 4☐

a. Harvest 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)Understand homeostasis in the animal body pre-harvest, understand stunning methods used for disrupting homeostasis, convey the relative importance of blood color during exsanguinations, note the physiological changes in muscle pH, temperature, and rigor and how meat is developed from a combination of these post-mortem factors, what effects stress has on post-mortem muscle quality, distinguish genetic and environmental (nutrition, gender, diet, transportation, weather) that can lead to low quality meat products, explain the undesirable conditions that occur in conversion (thaw rigor and cold shorting) , convey the importance in muscle quality of electrical stimulation in beef carcass, and note any type of accelerated processing that occurs in the meat industry.(CA) 2.) attend local slaughter plant and observe the process. (Butch) 3.) Describe how a carcass is slaughtered, and what parts are removed from the animal during harvest. (CS). 4.) not necessarily participate in activity but understand humane slaughter. (HDL) 5.) begin to realize the sumic and art of meat animal harvest. (GCS) 6.) Understand in general terms how animals are harvested and what factors relate to meat quality.(FP)

b. Color 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)Explain the physiological changes in muscle quality(color) that are affected by pH, temperature, and time of conversion, explain the three main attributes to color (hue, chroma, and value)and what muscle pigments proteins aid in color formation (hemoglobin and myoglobin), note other differences in muscle color between species due to predominant muscle fiber typing, note the pre to post-mortem changes in forms of myoglobin to formation of meat color.(CA) 2.) will learn the difference in color from beef, lamb, and pork both smoked and fresh. They will also learn what PSE meat looks like as well as old and youthful. (Butch)3.) ID normal, superior and inferior color of meat, as it deals with retail identification, freshness, and quality. (CS) 4.) Factors that affect color/ (HDL) 5.)Recognized and understand changes in meat color (GCS) 6.) Understand how color is developed and why it is important.(FP)

c. Fresh Meat Properties 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)understand the properties of fresh meat post-mortem, including pH, temperature change, rigor state, water-holding capacity, muscle location in relation to tenderness, types of fat, location of bones (anatomy of the animal body), muscle contraction, contractile proteins (sarcomere length), muscle fiber types of muscles and differences between species. (CA) 2.) Ties in with 3b (Butch) 3.)ID those properties that will be readily accepted or rejected by consumers. (CS) 4.) WHC importance (HDL) 5.) recognized and elaborate upon the many properties of meat. (GCS) 6.)Understand what factors influence fresh meat properties and how it relates to meat quality charateristics.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

4. Fabrication. 1☐ 2☐ 3☐ 4☐

a. Wholesale cuts / Boxed 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)How carcasses are cut into 4 main wholesale cuts, distinguish between the high merchandizing valued middle-meats, relay the relative importance of boxed beef and why this type of processing was introduced in the US.(CA) 2.) We can watch the total process at our local locker and at the same time explain what boxed beef is if they need to order for large numbers of special cuts. (Butch) 3.) identify where retail cuts come from, and validate classes of carcasses, and wholesale cuts to determine which is best and worst. This is good training for either meat plant sales personnel, or HRI and retail store mangers. (CS) 4.) Identify major wholesale cuts/parts (poultry) (HDL) 5.) become acquainted with carcass, wholesale cuts and shipment. (GCS) 6.) Students understand what are the wholesale cuts and where they come from. Should this be taught in a course, one might consider subprimals etc. that compose boxed meat.(FP)

b. Retail cuts 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)Distinguish between the many retail cuts of meat due to color of the lean, size of the muscles, anatomy (size, shape, etc) of the muscle, the presence of bone, connective tissue or fat into describing a retail cut. (CA) 2.) My Ag 1 meats class is now only the introduction to the meat industry but also the start of working towards our District FFA meats judging course. The students will

be able to identify meat cuts by species, wholesale cut and retail name of beef, lamb, and pork as well as smoked pork. (Butch).3.)Identify common retail cuts of beef, pork, and lamb; validate classes of retail cuts from a consumer's perspective. (CS) 4.) Identify major retail cuts of meat. (HDL) 5.) begin to recognize individual retail cuts from the different wholesale cuts of a specific species. (GCS) 6.)dentify general retail cuts, muscle and bone anatomy and where the cuts originate.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

5. Grades of Livestock and Meat 1☐ 2☐ 3☐ 4☐

a. Quality 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: (1.)Differentiate between youthful and mature carcasses in the USDA Grading System, determine overall maturity of a carcass using lean and skeletal maturity, validate USDA marbling scores in beef carcass ribeyes, calculate the final USDA Quality Grade using overall maturity, marbling scores and the USDA Quality Grading grid, understand the significance of quality grading on carcass merchandizing values and how grid pricing is affected in the industry, compare and contrast how different carcasses are graded and their relative difference in merchandizing value, note the various defects that would cause a carcass to not be processed (diary type, dark cutters, blood splash, calloused, etc) and what effects each has on quality.(CA). 2.) The students will be able to call the age and marbling scores of swinging beef carcasses and put the correct quality grade to the carcasses again this is in preparation for the contest. (Butch) 3.) Beef USDA quality grade, determine inferior quality of pork, lamb, and the use this information to validate classes of carcasses, wholesale cuts, and retail cuts. (CS). 4.) know factors associated with grade application. (HDL) 5.) become familiar with the grades and their usefulness in pricing and in first acceptability of the product. (GCS) 6.) Understand how to determine quality grades, factors involved, what influences them and why they are important.(FP)

b. Yield 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.) understand how to convert fat thickness in tenths of inches to a USDA Preliminary Yield Grade, understand the relationship between carcass weight and required ribeye area for carcasses, estimate the size of a longissimus muscle (ribeye) on beef cattle, understand the marketing problems associated with low yielding (USDA YG 4's and 5's), extremely small or large ribeye carcasses,

determine the percentage of kidney, pelvic, and heart fat and convert to an adjustment to the yield grade equation, calculate a final USDA Yield Grade using the Preliminary Yield Grade, adjusting for Hot Carcass Weight, Ribeye Area, and Kidney, Pelvic and Heart Fat percentage, compare and contrast different yield grades of beef carcasses to their relative yield of retail cuts.(CA) 2.) they will be able to estimate the fat at the 13th rib, square inches of REA, and KPH fat. They will also be able to figure the yield grade with these estimates when given the carcass weight. again in preparation for the contest (Butch) 3.) Beef USDA yield grade, determine trimness and muscling of pork and lamb as it deals with the evaluation of classes of carcasses, wholesale cuts, and retail cuts. (CS) 4.) Know factors associated with grade application. (HDL) 5.) Become familiar with the grades and their usefulness in pricing and acceptability of the product at the wholesale level.(GCS)6.)Understand how to determine yield grades, what influences them, and how to improve cutability.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

6. Food Safety 1☐ 2☐ 3☐ 4☐

a. Sanitation, SOP, GMP 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)demonstrate the relative importance of Sanitation in a meat facility, relay the importance of standard operating procedures for sanitation, daily operations, and inspection.(CA) 2.Students will be introduced to proper cooking temperatures for meat. (Butch) 3.) identify safe and unsafe sanitation practices, (CS). 4.) use sanitation principles in combination with meat micro. (HDL) 5.) Appreciate a clean environment at all times. (GCS) 6.) Understand standard sanitation, SOP and GMP operations, why they are important and how they fit into the regulatory environment.(FP)

b. Microbiology, Meat as a culture 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.Understand the importance of sanitation and environment on various types of microorganisms, convey the conditions in meat facilities that make a optimum environment for bacterial growth, understand the sterility of whole muscle tissue and what happens during processing (ground beef), relate the relative growth cycle of bacteria to the meat facility.(CA) 2.) Don't teach (Butch) 3.) Discuss various microorganisms, what products they are a danger in, and how to kill them. (CS) 4.) understand factors that affect MO contamination and growth. (HDL) 5.) realized the potential of any food hazard and ways to control

such. (GCS) 6.) Understand the microbiological threat to food safety of meat, what factors influence it and how to improve meat safety.(FP)

c. Inspection 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.) Understand the importance of USDA inspection in the US, convey why the Meat Inspection act was passed (and because of whom), note what items are inspected (when and where). (CA) 2.) we get to watch the Federal inspector at the locker so most of this is done at the locker. (Butch) 3.) discuss what parts of a carcass a meat inspector will look at to determine wholesomeness. (CS) 4.) understand purpose of inspection. (HDL) 5.) recognized this government program and recognized its potential to control food safety. (GCS) 6.) To understand how meat inspection has evolved and how it relates to a safe and wholesome meat supply. Comment: This would probably be just a brief look at inspection and why it is important.(FP)

d. HACCP 1☐ 2☐ 3☐ 4☐

1 .the student will be able to

Comments: 1.)Understand the cite the 7 majors areas of HACCP, note who started HACCP and for what program, develop a HACCP program for a small meat facility. (CA)2.) not covered (Butch) 3.) discuss what HACCP is and what the segments of HACCP are. (CS) 4.) awareness of how used but not develop a plan. (HDL) 5. note that all personnel involved in the meat chain is indeed responsible for the safety of the food on the consumer's plate. (GCS) 6.) Understand what HACCP is and what is involved in creating a HACCP plan. Comment: Again, for this type of course, you couldn't nor probably shouldn't go into great detail. I would recommend only an introduction to the components that go into a plan.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

7. Meat and the Human Diet 1☐ 2☐ 3☐ 4☐

a. Food Groups 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.) Utilized the newest food pyramid to establish a healthy diet with all essential nutrients. (CA) 2.) not taught (Butch) 3.) identify what the major food groups are and how and why meat is important to an individual's diet. (CS) 4.) no comment (HDL) 5.) see the importance of meat in the human food supply. (GCS)

6.) Understand what constitues the food groups and how to follow the new food guide pyrimid. (FP)

b. Nutrition of Meat 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)Recite the relative composition of meat products, including protein, fat, minerals, vitamins and any necessary elements that are not provided by other food-stuff(CA).2.) taught in home ec. (Butch) 3.) discuss the nutrient density of meat, and what major vitamins and minerals meat a good source is of. (CS) 4.) role of meat in the diet (HDL) 5.) briefly understand the vast amount of nutrients that are in the lowly hamburger and also all meat products. Note: take C of Topic I might fit here better, or just be sure you don't repeat much. (GCS) 6.) Understand the nutrient composition of meat and how meat fits into a wholesome diet. Comment: This section is important to present the facts about meat nutrition since meat oftens gets a one sided and negative approach from the popular press.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

8. Meat Preservation 1☐ 2☐ 3☐ 4☐

a. Curing and Smoking 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 1.)Understand the chemical properties and changes that occur in smoke and cured meat products, define the terms smoking and curing, note the history of meat curing and drying from the time of Homer (850 BC) to the present, note the main ingredients that are included in smoked and cured products, relate the importance (and detriments) of using Nitrate in cured products, note the importance of using salt, phosphates, other products (isolated soy proteins, Vitamin E etc) and seasonings in developing meat product qualities and their effects on texture, flavor, appearance, aroma, water-holding capacity, preventing oxidative rancidity, note the chemistry of myoglobin in development of cured color in meat products, validate the stability of cured meat pigments and the public health aspects of nitrite usage.(CA).2.) We don't do anything with this except knowing the ID of the smoked cuts for the contest. (Butch) 3.) Identify and discuss various curing chemicals, and why they are used. (CS) 4.) Basic principles. (HDL) 5.) Note differences as meat is processed. (GCS). 6.) Understand the origins, why and how meat is cured and smoked. They should also learn about product attributes created from these process and what constitues high quality.(FP)

b. Sausage 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.)Differentiate between the origins of sausages from their names, observe the different ingredients used to make various types of sausages (meats, seasonings, fillers, etc), distinguish between the different types of casings in making sausages (natural versus manufactured), differentiate between the four types of manufactured sausage casings and each of their relative characteristic to that sausage, note some problems in sausage making due to the casings, stuffing techniques, and cooking lengths. (CA) 2.) We don't do anything with this except knowing the ID of the smoked cuts for the contest. (Butch) 3.) Discuss why we grind meat, as well as why we smoke or cure meat. (CS) 4.) Basic principles of manufacturing and because is fun! (HDL) 5.) Become acquainted with the most important and largest groups of meat compounds. (GCS) 6.) Understand the origins, why and how meat is cured and smoked. They should also learn about product attributes created from these process and what constitues high quality.(FP)

c. Value added processing 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.) Understand the importance of research to find or add value to products that were considered low value before, extrapolate on any type of new product that could be utilized to take a niche away from a certain species in the market place (beef bacon?) and what characteristics make it a good or bad choice to present a value-added product (from the muscle chemistry of that product). (CA) 2.) N/A (Butch) 3.) Identify and discuss ways to add value to carcasses and primal cuts by processing (example: flat iron steak) (CS) 4.) Disagree (HDL) 5.) Note the importance of continued studies and research to obtain new products and new systems of selling meat products. (GCS) 6.) Understand the major processes involved with adding value to whole muscle and comminuted meat. Students should also gain understanding in how meat is packaged and merchandized. Comment: This is an important section since much of our meat is valued added and the trend is to continue that direction.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

9. By-Products 1☐ 2☐ 3☐ 4☐

a. Edible 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.) List various types of edible products that can come from by-products of a processing facility (CA) 2.) They learn what the variety meats are from the 3 species (Butch) 3.) Identify various edible by-products by sight, and discuss their uses. (CS) 4.) Awareness of (HDL) 5.)See the great diversity that edible by-products being to the meat food groups (GCS) 6.) Understand the harvest, processing and uses for major edible animal by-products. (FP)

b. Inedible 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.)list and explain about the various type of medical, health, beauty, aesthetic, and other products that can come as by-products of the meat processing industry.(CA) 2.) Nothing done in this area (Butch) 3.) Discuss the uses of inedible by-products (CS) 4.) Awareness of (HDL) 5.)See the great value that animal harvest presents to society in addition to food (GCS). 6.) Understand the harvest, processing and uses for major inedible animal by-products(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

10. Overview of FFA Career Development Events 1☐ 2☐ 3☐ 4☐

MEATS 1☐ 2☐ 3☐ 4☐

i. Written 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.) N/A (CA) 2.) My kid like the meats CDE and that is how my meats curriculum is set up especially in the Ag 1 class (Butch) 3.)Formulate a least cost mixture of ground meat; identify safe handling procedures, safe storage procedures, and other general meat knowledge. (CS) 4.) Good information however we need a better resource than the Yellow Pages. (HDL) 5.) See notes (GCS) 6.) To develop basic knowledge and problem solving skills for the meat industry.(FP)

ii. ID 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.)identify and differentiate between various species, wholesale and retail cuts of meat and any smoked & cured, various and variety meats that come from different species and relate the importance of these cuts in terms of merchandizing meat.(CA) 2.) Identify retail cuts by species, primal, and retail names of beef, pork, and lamb. (CS) 3. Compliments class materials.(HDL) 4.) Determine cut identification, primal cut of origin and species of origin for meat cuts. (FP)

iii. Grading 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.)calculate USDA Quality and Yield Grades of beef carcasses and understand the concepts behind calculated percent muscle in pork, US Grades in pork and how to USDA Quality and Yield Grade lamb carcasses. (CA)2.) See 5a and b above (Butch) 3.) Beef USDA Quality Grade and Yield Grade, to within a third of a grade. (CS) 4.) Application of class information (HDL) 5.) See notes at end of survey (GCS) 6.) Determine quality and yield grades for beef carcasses (or if , beef cuts i.e. ribs) Comment: because of cost, beef ribs or rib steaks are preferential if carcasses cannot be used.(FP)

iv. Class Placing 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.)validate four exhibits of beef, pork, or lamb and rank these due to quality, muscling and trimness due to criteria set forth by meat animal merchandizing in the United States or abroad.(CA) 2.)Will know the placing criteria for the different cuts in the contest (Butch) 3.) Validate beef, pork, and lamb carcasses, primal cuts, and retail cuts. (CS) 4.) Simulates consumer decision making. (HDL) 5.) See notes at end of survey (GCS) 6.) To devolop problem solving skills by determining value of meat carcass or cut classes.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

b. Poultry. 1☐ 2☐ 3☐ 4☐

i. Class Placing 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.) Determine relative value and placing of poultry classes.(FP) 2.) Belongs in Poultry production Class

ii. Quality grades 1☐ 2☐ 3☐ 4☐

1 .the student will be able to

Comments: 1.)Indicate and demonstrate poultry grading.(FP)

iii. Eggs 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.) Comment: Since this isn't muscle, I wouldn't probably recommend this in the class.(FP)

iv. Further processing 1☐ 2☐ 3☐ 4☐

2. the student will be able to

Comments: 1.) Understand the major processes utilized to generate value to poultry products.(FP)

Appendix J

Study of Meat Science Topics for Secondary Agricultural Education with Common/Objects Consolidated with Mean and Standard Deviation

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

	1 SD	**2 D**	**3 A**	**4 SA**
1. Overview of Livestock And Meat Industry	1☐	2☐	3☐	4☐
a. History-	1☐	2☐	3☐	4☐

1. The student will be able to

Comments: 1.0) mean= 3.13 SD=0.99 1.a MEAN 3.00 SD 1.15
1) list scientific names of major classes of livestock and where domesticated. CS
2) understand the historical events that change or modified the industry (ex. refrigeration and the jungle)DL
3) understand the history of the meat packing industry, noting the changes from NE states to Central Plains (refrigeration, rail roads, interstate highways systems, disassembly of carcass from Henry Ford assembly.CA
4) show how American History and Meat Science are closely related.GS.
5) understand how the meat industry has evolved and why includeing technological innovations, change in processing centers and why. (FP)

b. Meat as a part of culture	1☐	2☐	3☐	4☐

1. The student will be able to

Comments: 1.b MEAN=2.75 SD 0.89
1) observe the relative changes in consumer consumption of meat products over the past 100 years.
1.2) understand what has caused these changes, know the history of meat consumption in various cultures around the world.
1.3) what they commonly view as sacred or what animals were used for),
1.4) understand and contemplate the social status of consuming meat in the US and abroad, and
1.5) understand the categories of meat products. (CA).
2) recognized that meat helps determine the culture of a group of people. (GS)
3) understand what drives meat consumption as related to culture and how the industry fits and might fit in the future.(FP)

c. Meat and World Hunger 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 1.c MEAN=2.29 SD=0.76
1) talk on how most people don't have enough to eat. (CS
2) understand and relay the relative world populationfrom 2000 years ago to the present, noting the relative ability of the world to feed itself.(CA)
3) understand the value of meat in any progress that can be realized in eliminating world hungry.(GS)
4) understand the link between socioeconomic drivers and consumption of meat in devolping and devoloped countries. Futhermore, this could also be linked to meat's role in a healthy diet and how it fits with alliviating world hunger.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

2. Supermarket Survey 1☐ 2☐ 3☐ 4☐

a. Visit to supermarket 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 2.0 MEAN=3.00 SD=1.15 2.a MEAN=3.57 SD=0.53
1) keep a daily log of meat and meat cuts they consume, then go to supermarket after retail cuts are known. (BW)
2) ID retail cuts in meat counter and determine what cut they want to buy. (CS)
3) ID items available to consumer (DL)
4) ID products by label, species, Cuts wholesale and retail, meat labels components, case ready products, types of packaging. (CA).
5) begin to understand the movement of meat from farm to table. (GS)
6) understand how meat is packaged, prepared and marketed, also learning about technologies to improve shelf-life and salability (sale ability) and why these are important.(FP)

b. Report to class 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 2.B MEAN=2.57 SD=0.98
2) discuss findings of supermarket survey. (CS)
3) report on findings of supermarket survey,
3.1) research a new topic on technology or research in meat science (CA)
4) relate their own ideas from a supermarket study of meat and the consumer. (GS)

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5) to digest what they have learned and gives them the opportunity to communicate what they have learned.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

3. Muscle to Meat 1☐ 2☐ 3☐ 4☐

a. Harvest 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 3.0 MEAN=3.25 SD=1.04 3.A MEAN=3.25 SD=0.71
1) understand the factors effecting the animal body pre-harvest, harvest and post-harvest and how meat is developed from a combination of these factors,
1.1) note any type of accelerated processing that occurs in the meat industry.(CA)
2) attend local slaughter plant and observe the process. (BW)
3) describe how a carcass is slaughtered, and what parts are removed from the animal during harvest. (CS).
4) not necessarily participate in activity but understand humane slaughter. (DL)
5) begin to realize the science and art of meat animal harvest. (GS)
6) understand in general terms how animals are harvested and what factors relate to meat quality.(FP)

b. Color 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 3.b MEAN=3.63 SD=0.52
1) explain the physiological changes in muscle quality(color) and the factors that affected color.(CA)
2) will learn the difference in color from beef, lamb, and pork both smoked and fresh. They will also learn what PSE meat looks like as well as old and youthful. (BW)
3) ID normal, superior and inferior color of meat, as it deals with retail identification, freshness, and quality. (CS)
4) factors that affect color/ (DL)
5) recognized and understand changes in meat color (GS)
6) understand how color is developed and why it is important.(FP)

c. Fresh Meat Properties 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 3.c MEAN=3.63 SD=0.52

1) understand the properties of fresh meat post-mortem, including pH, temperature change, rigor state, water-holding capacity, muscle location in relation to tenderness, types of fat, location of bones (anatomy of the animal body), . (CA)
3) ID those properties that will be readily accepted or rejected by consumers. (CS)
4) understand water holding capacity importance (DL)
5) recognized and elaborate upon the many properties of meat. (GS)
6) understand what factors influence fresh meat properties and how it relates to meat quality charateristics.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

4. Fabrication. 1☐ 2☐ 3☐ 4☐

a. Wholesale cuts / Boxed 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 4.0 MEAN=3.38 SD=0.74 4.a MEAN=3.43 SD=0.79
1) know how carcasses are cut into 4 main wholesale cuts,
1.1) distinguish between the high merchandizing valued middle-meats,
1.2) relay the relative importance of boxed beef and why this type of processing was introduced in the US.(CA)
2) watch the total process at a local locker.
2.1) explain what is boxed beef and why important. (BW)
3) identify where retail cuts are located and from which wholesale cut
3.1) validate classes of carcasses, and wholesale cuts to determine which is best and worst. (CS)
4) identify major wholesale cuts/parts (DL)
5) become acquainted with carcass, wholesale cuts and shipment. (GS)
6) understand what are the wholesale cuts and where they come from and how this is turned into boxed product.(FP)

b. Retail cuts 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 4.b MEAN=3.63 SD=0.52
1) distinguish between the many retail cuts of meat due to color of the lean, size of the muscles, anatomy (size, shape, etc) of the muscle, the presence of bone, connective tissue or fat into describing a retail cut. (CA)
2) identify meat cuts by species, wholesale cut and retail name of beef, lamb, and pork as well as smoked pork. (BW).

3) identify common retail cuts of beef, pork, and lamb; validate classes of retail cuts from a consumer's perspective. (CS)
4) identify major retail cuts of meat. (DL)
5) begin to recognize individual retail cuts from the different wholesale cuts of a specific species. (GS)
6) identify general retail cuts, muscle and bone anatomy and where the cuts originate.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

5. Grades of Livestock and Meat 1☐ 2☐ 3☐ 4☐

a. Quality 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 5.O MEAN=3.88 SD=0.35 5.a MEAN=3.63 SD=0.74
1) differentiate between youthful and mature carcasses in the USDA Grading System,
1.1 determine overall maturity of a carcass using lean and skeletal maturity,
1.2 validate USDA marbling scores in beef carcass ribeyes,
1.3 calculate the final USDA Quality Grade using overall maturity, marbling scores and the USDA Quality Grading grid,
1.4 understand the significance of quality grading on carcass merchandizing values and how grid pricing is affected in the industry, compare and contrast how different carcasses are graded and their relative difference in merchandizing value, note the various defects that would cause a carcass to not be processed (diary type, dark cutters, blood splash, calloused, etc) and what effects each has on quality.(CA).
2) call the age and marbling scores of swinging beef carcasses and put the correct quality grade to the carcasses again this is in preparation for the contest. (BW)
3) beef USDA quality grade, determine inferior quality of pork, lamb, and the use this information to validate classes of carcasses, wholesale cuts, and retail cuts. (CS).
4) understand factors associated with grade application. (DL)
5) become familiar with the grades and their usefulness in pricing and in first acceptability of the product. (GS)
6) understand how to determine quality grades, factors involved, what influences them and why they are important.(FP)

b. Yield 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 5.b MEAN=3.75 SD=0.46
1) understand how to convert fat thickness in tenths of inches to a USDA Preliminary Yield Grade,
1.1 understand the relationship between carcass weight and required ribeye area for carcasses,
1.2 estimate the size of a longissimus muscle (ribeye) on beef cattle,
1.3 understand the marketing problems associated with low yielding (USDA YG 4's and 5's), extremely small or large ribeye carcasses,
1.4 determine the percentage of kidney, pelvic, and heart fat and convert to an adjustment to the yield grade equation,
1.5 calculate a final USDA Yield Grade using the Preliminary Yield Grade, adjusting for Hot Carcass Weight, Ribeye Area, and Kidney, Pelvic and Heart Fat percentage, compare and contrast different yield grades of beef carcasses to their relative yield of retail cuts.(CA)
2) estimate the fat at the 13th rib, square inches of REA, and KPH fat.
2.1 figure the yield grade with these estimates when given the carcass weight.(BW)
3) determine beef USDA yield grade, trimness and muscling of pork and lamb, as it deals with the evaluation of classes of carcasses, wholesale cuts, and retail cuts. (CS)
4) undestand factors associated with grade application. (DL)
5) become familiar with the grades and their usefulness in pricing and acceptability of the product at the wholesale level.(GS)
6) understand how to determine yield grades, what influences them, and how to improve cutability.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

6. Food Safety 1☐ 2☐ 3☐ 4☐

a. Sanitation, SOP, GMP 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 6 MEAN=3.75 SD=0.46 6.a MEAN=2.57 SD=1.27
1) demonstrate the relative importance of Sanitation in a meat facility, relay the importance of standard operating procedures for sanitation, daily operations, and inspection.(CA)
2) understand proper cooking temperatures for meat. (BW)

3) Identify safe and unsafe sanitation practices, (CS).
4) understand the importance of sanitation principles in combination with meat micro. (DL)
5) appreciate a clean environment at all times. (GS)
6) understand standard sanitation, SOP and GMP operations, why they are important and how they fit into the regulatory environment.(FP)

b. Microbiology, Meat as a culture 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 6.b MEAN=3.25 SD=1.04
1)understand the importance of sanitation and environment on various types of microorganisms,
1.1 convey the conditions in meat facilities that make a optimum environment for bacterial growth,
understand the sterility of whole muscle tissue and what happens during processing (ground beef), relate the relative growth cycle of bacteria to the meat facility.(CA)
3) discuss various microorganisms, what products they are a danger in, and how to kill them. (CS)
4) understand factors that affect MO contamination and growth. (DL)
5) realized the potential of any food hazard and ways to control. (GS)
6) understand the microbiological threat to food safety of meat,
6.1 what factors influence it and how to improve meat safety. (FP)

c. Inspection 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 6.c MEAN=3.13 SD=0.83
1) understand the importance of USDA inspection in the US, convey why the Meat Inspection act was passed (and because of whom), note what items are inspected (when and where). (CA)
2) to watch the Federal inspector at a locker plant. (BW)
3) discuss what parts of a carcass a meat inspector will look at to determine wholesomeness. (CS)
4) understand purpose of inspection. (DL)
5) recognized this federal government program and the potential to control food safety. (GS)
6) understand how meat inspection has evolved and how it relates to a safe and wholesome meat supply. (FP)

d. HACCP 1☐ 2☐ 3☐ 4☐

1 .the student will be able to

Comments: 6.d MEAN=2.71 SD=1.11
1)understand the 7 majors areas of HACCP, note who started HACCP and for what program. (CA)
3) discuss what HACCP is and what the segments of HACCP are. (CS)
4) awareness of how used but not develop a plan. (DL)
5) note that all personnel involved in the meat chain is indeed responsible for the safety of the food on the consumer's plate. (GS)
6) understand what HACCP is and what is involved in creating a HACCP plan. (FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

7. Meat and the Human Diet 1☐ 2☐ 3☐ 4☐

a. Food Groups 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 7.0 MEAN=2.86 SD=1.35 7.a MEAN=2.71 SD=1.60
1) utilized the newest food pyramid to establish a healthy diet with all essential nutrients. (CA)
3) identify what the major food groups are and how and why meat is important to an individual's diet. (CS)
5) understand the importance of meat in the human food supply. (GS)
6) understand what constitues the food groups and how to follow the new food guide pyrimid. (FP)

b. Nutrition of Meat 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 7.b MEAN=3.00 SD=1.41
1) recite the relative composition of meat products, including protein, fat, minerals, vitamins and any necessary elements that are not provided by other food-stuff. (CA)
3) discuss the nutrient density of meat, and what a good source of major vitamins and minerals found in meat. (CS)
4) understand role of meat in the diet (DL)
5) briefly understand the vast amount of nutrients that are in the lowly hamburger and also all meat products. Note: take C of Topic I might fit here better, or just be sure you don't repeat much. (GS)

6) understand the nutrient composition of meat and how meat fits into a wholesome diet. Comment: This section is important to present the facts about meat nutrition since meat oftens gets a one sided and negative approach from the popular press.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

8. Meat Preservation 1☐ 2☐ 3☐ 4☐

a. Curing and Smoking 1☐ 2☐ 3☐ 4☐

1. the student will be able to

Comments: 8.0 MEAN=3.13 SD1.13 8.a MEAN=2.88 SD=0.99
1) nderstand the chemical properties and changes that occur in smoke and cured meat products,
1.1define the terms smoking and curing, note the history of meat curing
1.2 note the main ingredients that are included in smoked and cured products.(CA).
3) identify and discuss various curing chemicals, and why they are used. (CS)
4) understand the basic principles. (DL)
5) understand differences as meat is processed. (GS).
6.) understand the origins,
6.1 know how meat is cured and smoked and why.
6.2 understand product attributes created from these process and what constitues high quality.(FP)

b. Sausage 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 8.b MEAN=2.50 SD=1.31
1) differentiate between the origins of sausages from their names,
1.1 observe the different ingredients used to make various types of sausages (meats, seasonings, fillers, etc),
1.2 distinguish between the different types of casings in making sausages (natural versus manufactured),
1.3 differentiate between the four types of manufactured sausage casings and each of their relative characteristic to that sausage, note some problems in sausage making due to the casings, stuffing techniques, and cooking lengths. (CA)
3) discuss why we grind meat, as well as why we smoke or cure meat. (CS)
4) understand basic principles of manufacturing and because is fun! (DL)
5) become acquainted with the most important and largest groups of meat compounds. (GS)

6) understand the origins, why and how meat is cured and smoked.
6.1 understand product attributes created from these process and what constitues high quality.(FP)

c. Value added processing 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 8.c MEAN=3.00 SD=1.07
1) understand the importance of research to find or add value to products that were considered low value
1.1 understand the development of new product that could be utilized as a niche market in the market place (beef bacon?)
1.2 understand the characteristics used to make a good or bad choice to present a value-added product. (CA)
3) identify and discuss ways to add value to carcasses and primal cuts by processing (example: flat iron steak) (CS)
5) understand the importance of continued studies and research to obtain new products and new systems of selling meat products. (GS)
6) understand the major processes involved with adding value to whole muscle and comminuted meat.
6.1 understanding how meat is packaged and merchandized. (FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

9. By-Products 1☐ 2☐ 3☐ 4☐

a. Edible 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 9.0 MEAN=3.00 SD=1.07 9.a MEAN=3.00 SD=1.15
1) List various types of edible products that can come from by-products of a processing facility (CA)
2) understand what the variety meats are from the 3 species (BW)
3) identify various edible by-products by sight, and discuss their uses. (CS)
4) understand the various edible by-products. (DL)
5) understand the great diversity that edible by-products bring to the meat food groups (GS)
6) understand the harvest, processing and uses for major edible animal by-products. (FP)

b. Inedible 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 9.b MEAN=3.29 SD=1.11
1) List and explain the various type of medical, health, beauty, aesthetic, and other products that can come as by-products of the meat processing industry.(CA)
3) discuss the uses of inedible by-products (CS)
4) understand the awareness of (DL)
5) understand the great value that animal harvest presents to society in addition to food (GS).
6) understand the harvest, processing and uses for major inedible animal by-products(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

10. Overview of FFA Career Development Events 1☐ 2☐ 3☐ 4☐

MEATS 1☐ 2☐ 3☐ 4☐

i. Written 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 10.0 MEAN=3.29 SD=1.11 10.a.i mean=2.33 SD=1.51
2) My kids like the meats CDE and that is how my meats curriculum is set up especially in the Ag 1 class (Butch)
3) formulate a least cost mixture of ground meat;
3.1 identify safe handling procedures,
3.2 understand safe storage procedures,
3.3 understand general meat knowledge. (CS)
4) Good information however we need a better resource than the Yellow Pages. (DL)
5) see notes at end (GS)
6) develop basic knowledge and problem solving skills for the meat industry.(FP)

ii. ID 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 10.aii MEAN = 3.29 SD = 1.11
1) identify and differentiate between various species, wholesale and retail cuts of meat and any smoked & cured, various and variety meats that come from different species and relate the importance of these cuts in terms of merchandizing meat.(CA)

2) identify retail cuts by species, primal, and retail names of beef, pork, and lamb. (CS)
3) Compliments class materials.(DL)
4) determine cut identification, primal cut of origin and species of origin for meat cuts. (FP)

iii. Grading 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 10.a.iii Mean = 3.14 SD = 1.21
1) calculate USDA Quality and Yield Grades of beef carcasses
1.1 understand the concepts behind calculated percent muscle in pork, US Grades in pork
1.2 calculate USDA Quality and Yield Grade lamb carcasses. (CA)
3) calculate beef USDA Quality Grade and Yield Grade, to within a third of a grade. (CS)
4) apply class information (DL)
5) see notes at end of survey (GS)
6) determine quality and yield grades for beef carcasses (or if , beef cuts i.e. ribs) (FP)

iv. Class Placing 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 10.a.iv Mean = 3.14 SD = 1.21
1) validate four exhibits of beef, pork, or lamb and rank these due to quality, muscling and trimness due to criteria set forth by meat animal merchandizing in the United States or abroad.(CA)
2) will know the placing criteria for the different cuts in the contest (BW)
3) validate beef, pork, and lamb carcasses, primal cuts, and retail cuts. (CS)
4) learn consumer decision making. (DL)
5) see notes at end of survey (GS)
6) devolop problem solving skills by determining value of meat carcass or cut classes.(FP)

Directions: Rate each numbered item on the Likert scale using the following 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. Also please provide suggested objectives for each of the subtopics.

b. Poultry. 1☐ 2☐ 3☐ 4☐

i. Class Placing 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 10.b Mean = 1.86 SD = 0.90 10.bi Mean = 1.67 SD = 0.82
1) determine relative value and placing of poultry classes.(FP)
2) Belongs in Poultry production Class(MH)

ii. Quality grades 1☐ 2☐ 3☐ 4☐

1 .the student will be able to

Comments: 10.b.ii Mean = 2.14 SD = 1.21
1) indicate and demonstrate poultry grading.(FP)

iii. Eggs 1☐ 2☐ 3☐ 4☐

1. The student will be able to

Comments: 10.b.iii Mean = 1.57 SD = 0.98
1) Comment: Since this isn't muscle, I wouldn't probably recommend this in the class.(FP)

iv. Further processing 1☐ 2☐ 3☐ 4☐

3. the student will be able to

Comments: 10.b.iv Mean = 1.83 SD = 1.33
1) understand the major processes utilized to generate value to poultry products.(FP)

Dr Skelley's notes

notes on topic ten and general comments. My vote is that this is too involved. can events be grouped more? This is all just a short analysis to see if they have an interest in a extracurrular activity of competition between schools. another pointis that may need to be considered is where does the meat study fits into the program? Is this up to the instructor in the high school? Should you have different levels for VoAg I, II, III, & IV ? I know when I took VoAg that the study supposedly became tougher each year? You really need to work on these items. another suggestion, do you need the evaluation of the overall. seams to be repetitive.

Appendix K

Study of Meat Science Topics for Secondary Agricultural Education with Standards Separated Out Under Each Topic with Likert-type Scale

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

OVERVIEW OF LIVESTOCK AND MEAT INDUSTRY

History-

The student will be able to:	**SD**	**D**	**A**	**SA**
• list scientific names of major classes of livestock and where domesticated. Revisions:	1☐	2☐	3☐	4☐
• understand the historical events that changed or modified the industry (refrigeration and "The Jungle") Revisions:	1☐	2☐	3☐	4☐
• understand the history of the meat packing industry, noting the changes from the NE states to the Central Plains (refrigeration, railroads, interstate highway systems, disassembly of carcass from Henry Ford assembly. Revisions:	1☐	2☐	3☐	4☐
• show how American History and Meat Science are closely related. Revisions:	1☐	2☐	3☐	4☐
• understand how and why the meat industry has evolved, including technological innovations, change in processing centers. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Meat as a Part of Culture

The student will be able to:	**SD**	**D**	**A**	**SA**
• observe the relative changes in consumer consumption of meat products over the past 100 years. Revisions:	1☐	2☐	3☐	4☐
• understand what caused these changes, know the history of meat consumption in various cultures around the world. Revisions:	1☐	2☐	3☐	4☐
• determine what animals are commonly viewed as sacred. Revisions:	1☐	2☐	3☐	4☐
• determine how animals are used Revisions:	1☐	2☐	3☐	4☐
• understand and contemplate the social status of consuming meat in the US or abroad, and understand the categories of meat products. Revisions:	1☐	2☐	3☐	4☐
• recognize that meat helps determine the culture of a people. Revisions:	1☐	2☐	3☐	4☐
• understand what drives meat consumption as related to culture and how the industry fits and might fit in the future. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

SUPERMARKET SURVEY

Visit to Supermarket

The student will be able to:	SD	D	A	SA
• keep daily log of meat cuts they consume, supermarket trip comes after retail cuts are known. Revisions:	1☐	2☐	3☐	4☐
• identify retail cuts in meat counter and be able to determine, what cut you want to buy. Revisions:	1☐	2☐	3☐	4☐
• identify items available to consumer. Revisions:	1☐	2☐	3☐	4☐
• identify products by label, species, cuts wholesale and retail, meat labels components, case ready products types of packaging. Revisions:	1☐	2☐	3☐	4☐
• begin to understand the movement of meat from farm to table. Revisions:	1☐	2☐	3☐	4☐
• understand how meat is packaged, prepared and marketed. Furthermore, students would also learn about technologies to improve shelf-life and saleability and why these are important. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Report of Survey to Class

The student will be able to:	SD	D	A	SA
• discuss findings of supermarket survey. Revisions:	1☐	2☐	3☐	4☐
• report on findings of supermarket survey, research a topic in new technology/research in meat science for tenderness, juiciness, flavor, ready to eat meats, heat and serve, and/or value added meat products. (Flat-Iron Steak) Revisions:	1☐	2☐	3☐	4☐
• relate their own ideas from a supermarket study of meat and the consumer. Revisions:	1☐	2☐	3☐	4☐
• process what they have learned and communicate their findings to others. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Muscle to Meat

Harvest

The student will be able:	SD	D	A	SA
• understand all factors affecting the animal body pre-harvest and how these factors affect the final product. Revisions:	1☐	2☐	3☐	4☐
• attend local slaughter plant and observe the process Revisions:	1☐	2☐	3☐	4☐
• describe how a carcass is slaughtered, and what parts are removed from the animal during harvest. Revisions:	1☐	2☐	3☐	4☐

- understand humane slaughter. 1☐ 2☐ 3☐ 4☐
  Revisions:

- realize the science and art of meat animal harvest. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand in general terms how animals are harvested and what factors relate to meat quality. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Color

The student will be able to:	SD	D	A	SA
• explain the physiological changes in muscle color, and the factors that affect changes. Revisions:	1☐	2☐	3☐	4☐
• describe the differences in color from beef, lamb, and pork both smoked and fresh. They will also learn what PSE (Pale Soft, and Exudative) meat looks like as well as old and youthful. Revisions:	1☐	2☐	3☐	4☐
• identify normal, superior and inferior color of meat, as it deals with retail identification, freshness, and quality. Revisions:	1☐	2☐	3☐	4☐
• understand the factors that affect color. Revisions:	1☐	2☐	3☐	4☐
• recognized and understand changes in meat color. Revisions:	1☐	2☐	3☐	4☐
• understand how color is developed and why color is important. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Fresh Meat Properties

The student will be able:	SD	D	A	SA
• understand the properties of fresh meat post-mortem and how the properties affect the final fresh meat product. Revisions:	1☐	2☐	3☐	4☐
• identify those properties that will be readily accepted or rejected by consumers. Revisions:	1☐	2☐	3☐	4☐
• understand the importance of water holding capacity (WHC). Revisions:	1☐	2☐	3☐	4☐
• recognize and elaborate upon the many properties of meat. Revisions: 0	1☐	2☐	3☐	4☐
• understand what factors influence fresh meat properties and how it relates to meat quality characteristics. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Fabrication

The student will be able to:	SD D A SA
• cut carcasses into the main wholesale cuts distinguishing between the high merchandizing valued Middle-meats and other cuts. Revisions:	1☐ 2☐ 3☐ 4☐
• relay the relative importance of boxed beef, and why this type of processing was introduced in the US. Revisions:	1☐ 2☐ 3☐ 4☐
• observe fabrication at a local processing plant. Revisions:	1☐ 2☐ 3☐ 4☐
• understanding the need for boxed product to fill large orders of special cuts. Revisions:	1☐ 2☐ 3☐ 4☐
• identify where retail cuts are found and validate carcass classes, and wholesale cuts to determine level of quality. Revisions:	1☐ 2☐ 3☐ 4☐
• identify major wholesale cuts. Revisions:	1☐ 2☐ 3☐ 4☐
• become acquainted with carcass, wholesale cuts and shipment.	1☐ 2☐ 3☐ 4☐
• understand what are the wholesale cuts and where found on the carcasses. Revisions:	1☐ 2☐ 3☐ 4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Retail Cuts

The student will be able to:	SD D A SA
• distinguish between the many factors effecting retail cuts. Revisions:	1☐ 2☐ 3☐ 4☐
• identify meat cuts by species, name the wholesale and retail cuts, including smoked products. Revisions:	1☐ 2☐ 3☐ 4☐
• identify common retail cuts of beef, pork, and lamb; validate classes of retail cuts from a consumer's perspective. Revisions:	1☐ 2☐ 3☐ 4☐
• identify major retail cuts of meat. Revisions:	1☐ 2☐ 3☐ 4☐
• begin to recognize individual retail cuts from the different wholesale cuts of a specific species Revisions:	1☐ 2☐ 3☐ 4☐
• identify general retail cuts, anatomy of muscle and bone and where cuts originate. Revisions:	1☐ 2☐ 3☐ 4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Grades of Livestock and Meat

Quality

The student will be able to:	SD D A SA
• differentiate between youthful and mature carcasses in the USDA grading systems. Revisions:	1☐ 2☐ 3☐ 4☐

- determine the age and marbling scores of swinging beef carcasses and put the correct quality grade on the carcasses. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand beef USDA quality grade, determine inferior quality of pork, lamb, and the use of this information to validate classes of carcasses, wholesale cuts, and retail cuts. 1☐ 2☐ 3☐ 4☐
  Revisions:

- know the factors associated with grade application. 1☐ 2☐ 3☐ 4☐
  Revisions:

- become familiar with the grades and their usefulness in pricing and acceptability of the product 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand how to determine quality grades, factors involved, what influences them, and why they are important. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Yield

The student will be able to: SD D A SA

- understand how to determine Preliminary Yield Grade(PYG). 1☐ 2☐ 3☐ 4☐
  Revisions:

- estimate fat thickness at the 12^{th} rib, square inches of Rib Eye Area(REA), Kidney Pelvic and Heart fat (KPH) and Hot Carcass Weight (HCW). Will use these factors to determine the final Yield Grade(YG). 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand USDA beef yield grade, determine trimness and muscling of pork, and lamb. Use this information in the evaluation of carcass classes, wholesale and retail cuts. 1☐ 2☐ 3☐ 4☐
  Revisions:

- associate factors used with grade application 1☐ 2☐ 3☐ 4☐
  Revisions:

- become familiar with the grades and their usefulness in pricing and acceptability of the product at the wholesale level. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand how to determine yield grades what influences them, and how to improve cutability. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Food Safety

Sanitation, SOP, GMP

The student will be able to: SD D A SA

- demonstrate the relative importance of sanitation in a meat facility, relay the importance of Standard Operating Procedures (SOP) for daily sanitation operations, and inspection. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the proper cooking temperatures for meat. 1☐ 2☐ 3☐ 4☐
  Revisions:

- identify safe and unsafe sanitation practices. 1☐ 2☐ 3☐ 4☐
  Revisions:

- use sanitation principles in combination with meat micro. 1☐ 2☐ 3☐ 4☐
  Revisions:

- appreciate a clean environment at all times 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand standard sanitation, SOP, and General Manufacturing Procedures(GMP) operations, why they are important and how they fit into the regulatory environment. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Microbiology, meat as a culture

The student will be able to: SD D A SA

- understand the importance of sanitation and environment on various types of microorganisms and how the condition of the meat facility affects bacterial growth. 1☐ 2☐ 3☐ 4☐
  Revisions:

- discuss various microorganisms, in what products are they a danger in, and how to kill them. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand factors that affect microorganism contamination and growth. 1☐ 2☐ 3☐ 4☐
  Revisions:

- realize the potential of any food hazard and ways to control. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the microbiological threat to food safety of meat, what factors influence food safety and how to improve. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Inspection

The student will be able to:	SD	D	A	SA

- understand the importance of USDA inspection in the US, and convey why the Meat Inspection Act was passed. 1☐ 2☐ 3☐ 4☐
  Revisions:
- observe meat inspector at a processing plant. 1☐ 2☐ 3☐ 4☐
  Revisions:
- discuss what parts of a carcass a meat inspector will look at to determine wholesomeness. 1☐ 2☐ 3☐ 4☐
  Revisions:
- understand purpose of inspection. 1☐ 2☐ 3☐ 4☐
  Revisions:
- recognize the government program of meat inspection and how this controls food safety. 1☐ 2☐ 3☐ 4☐
  Revisions:
- understand how meat inspection has evolved and relates to a safe and wholesome meat supply. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be

changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Hazard Analysis of Critical Control Points (HACCP)

The student will be able to:	SD	D	A	SA
• understand the 7 major areas of HACCP, who started this process and for what program. Revisions:	1☐	2☐	3☐	4☐
• develop a HACCP plan for a small meat facility. Revisions:	1☐	2☐	3☐	4☐
• discuss the segments of HACCP. Revisions:	1☐	2☐	3☐	4☐
• understand the principles, but not develop a plan. Revisions:	1☐	2☐	3☐	4☐
• note that all personnel involved in the meat chain are indeed responsible for the safety of the food on the consumer's table. Revisions:	1☐	2☐	3☐	4☐
• understand what HACCP is and what's involved in creating a HACCP plan without the development of an individual plan. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Meat and the Human Diet

Food Groups

The student will be able:	SD	D	A	SA
• utilized the newest food pyramid to establish a healthy diet with all essential nutrients. Revisions:	1☐	2☐	3☐	4☐
• identify what the major food groups are and how and why meat is important to an individual's diet. Revisions:	1☐	2☐	3☐	4☐
• understand the importance of meat in the human food supply. Revisions:	1☐	2☐	3☐	4☐
• understand what constitutes the food groups, and how to follow the new food guide pyramid. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Nutrition of Meat

The student will be able to:	SD	D	A	SA
• recite the relative composition of meat products, including protein, fat, minerals, vitamins, and any necessary elements that are not provided by other food-stuff. Revisions:	1☐	2☐	3☐	4☐
• discuss the nutrient density of meat, and identify the major vitamins and minerals found in meat. Revisions:	1☐	2☐	3☐	4☐

- understand the role of meat in the diet 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the vast amount of nutrients that are in the hamburger and other meat products. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the nutrient composition of meat and how meat fits into a wholesome healthy diet. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Meat Preservation

Curing and Smoking

The student will be able to: SD D A SA

- understand the chemical properties and the changes that occur in smoked and cured products. 1☐ 2☐ 3☐ 4☐
  Revisions:

- identify and discuss various curing chemicals, and why they are used. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the basic principles of curing and smoking. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the changes that occur during the process of curing and smoking. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the origins of, why and how meat is cured and smoked. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Sausage

The student will be able to:	SD D A SA
• differentiate between the origins of sausages from their names, observe the different ingredients used in various types of sausage and distinguish between the different types of casing. Revisions:	1☐ 2☐ 3☐ 4☐
• discuss why we grind, smoke, and cure meat Revisions:	1☐ 2☐ 3☐ 4☐
• understand the basic principles of manufacturing. Revisions:	1☐ 2☐ 3☐ 4☐
• become acquainted with the most important, and largest groups of meat compounds. Revisions:	1☐ 2☐ 3☐ 4☐
• understand the major product forms and production process for sausage and an appreciation for casing types and process techniques utilized in sausage manufacturing. Revisions:	1☐ 2☐ 3☐ 4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Value Added Processing

The student will be able to:	SD D A SA

- understand the importance of research to find or add value to products that were once considered of low value and to find niche markets. 1☐ 2☐ 3☐ 4☐
  Revisions:

- identify and discuss ways to add value to carcasses and primal cuts by processing (ex. Flat-iron steak) 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the importance of continued studies and research to obtain new products and new systems of selling meat products. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the major processes involved with adding value to whole muscle and comminuted meat. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand how meat is packaged and merchandized. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

By-Products

Edible

The student will be able to: SD D A SA

- list various types of edible products that can come from by-products of a processing facility. 1☐ 2☐ 3☐ 4☐
  Revisions:

- learn what the variety meats are from the 3 species. 1☐ 2☐ 3☐ 4☐
  Revisions:

- identify various edible by-products by sight, and discuss their uses. 1☐ 2☐ 3☐ 4☐
  Revisions:

- aware of various edible by-products. 1☐ 2☐ 3☐ 4☐
  Revisions:

- see the great diversity that edible by-products bring to the meat food groups. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the harvesting process and uses for major animal by-products. 1☐ 2☐ 3☐ 4☐
  Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Inedible

The student will be able to: SD D A SA

- list and explain the various type of medical, health, beauty, aesthetic, and other products that can come as by-products of the meat processing industry. 1☐ 2☐ 3☐ 4☐
  Revisions:

- discuss the uses of inedible by-products. 1☐ 2☐ 3☐ 4☐
  Revisions:

- become aware of importance of inedible by-products. 1☐ 2☐ 3☐ 4☐
  Revisions:

- see the great value that animal harvest presents to society in addition to food. 1☐ 2☐ 3☐ 4☐
  Revisions:

- understand the harvest, processing and

uses for major inedible by-products. 1☐ 2☐ 3☐ 4☐
Revisions:

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Events Overview of FFA Career Development

MEATS

Identification

The student will be able to:	SD	D	A	SA
• identify and differentiate various species, wholesale and retail cuts of meat fresh, smoked or cured. Revisions:	1☐	2☐	3☐	4☐
• identify a variety of meats that come from different species and relate the importance of these cuts in terms of merchandizing meat. Revisions:	1☐	2☐	3☐	4☐
• identify retail cuts by species, primal, and retail names of beef, pork, and lamb. Revisions:	1☐	2☐	3☐	4☐
• determine cut identification, primal cut and species of origin for meat cuts. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Grading

The student will be able to:	SD	D	A	SA
• calculate USDA Quality and Yield Grades of beef carcasses and understand the concepts behind calculated percent muscling in pork, US Grades in pork and how to calculate USDA Quality and Yield Grade lamb carcasses. Revisions:	1☐	2☐	3☐	4☐
• calculate beef USDA Quality Grade and Yield Grade, to within a third of a grade. Revisions:	1☐	2☐	3☐	4☐
• understand application of class information. Revisions:	1☐	2☐	3☐	4☐
• determine quality and yield grades for beef carcasses. Revisions:	1☐	2☐	3☐	4☐

Directions: Rate each item using the following Likert type 1=STRONGLY DISAGREE, 2=DISAGREE, 3=AGREE, 4=STRONGLY AGREE. By clicking the adjacent blue box of the adjunct number an X will appear. If a answer needs to be changed click again and then move to another number and click. Make any comments or revisions by placing the curser in the gray box that will turn black then as you type comments the text will move down the page.

Class Placing

The student will be able to:	SD	D	A	SA
• validate four exhibits of beef, pork, and lamb, and rank these due to quality, muscling and trimness by criteria set forth by meat animal merchandizing in the United States or aboard. Revisions:	1☐	2☐	3☐	4☐
• know the placing criteria for the different cuts in the contest. Revisions:	1☐	2☐	3☐	4☐
• validate beef, pork, and lamb carcasses,				

primal and retail cuts. 1☐ 2☐ 3☐ 4☐
Revisions:

- understand consumer decision making. 1☐ 2☐ 3☐ 4☐
  Revisions:

- develop problem solving skills by determining value of meat carcass or cuts classes. 1☐ 2☐ 3☐ 4☐
  Revisions:

Appendix L

Letter to Agricultural Education Teachers Asking for Assistance

Ag Teachers

I'm John K. Duke a Doctoral Candidate in Career and Technology Education at Clemson University with an emphasis in Agricultural Education. My Masters Degree was in the area of Meat Science and my doctoral dissertation research will be in the area of developing a basic Meat Science curriculum for secondary education. You have been selected by your State Director to participate in this study. I have designed a 100 item Likert Type Scale survey in Basic Meat Science that should take less than 45 min to complete. The survey was based on National FFA Meat Evaluation CDE and input from leaders in the meat science area. Please reply to this e-mail with your preference of an on-line or written format. Thanks you for your time and consideration.

John

John K. Duke
Agriculture Education Doctoral Candidate

Appendix M

Reminder for Research Input from Delphi Panel
and Agricultural Education Teachers

To: jriemann@certifiedangusbeef.com, HHunt@ksu.edu, hloveday@utk.edu,
Tpowell@meatscience.org
Subject: Input for dissertation
Cc: jkduke@CLEMSON.EDU, tdbbns@CLEMSON.EDU

Just a friendly reminder. I need your input on my dissertation. Thanks for your time and consideration. I can be reached at _____.

Thanks John

John K. Duke
Agriculture Education Doctoral Candidate

Appendix N

Letter Asking for Preference in Survey Type

>>> "John K. Duke" <jkduke@CLEMSON.EDU> 4/24/2007 3:08 PM >>>
Ag Teachers

I'm John K. Duke a Doctoral Candidate in Career and Technology Education at Clemson University with an emphasis in Agricultural Education. My Masters Degree was in the area of Meat Science and my doctoral dissertation research will be in the area of developing a basic Meat Science curriculum for secondary education. You have been selected by your State Director to participate in this study. I have designed a 100 item Likert Type Scale survey in Basic Meat Science that should take less than 45 min to complete. The survey was based on National FFA Meat Evaluation CDE and input from leaders in the meat science area. Please reply to this e-mail with your preference of an on-line or written format.

Thanks you for your time and consideration.

John

John K. Duke
Agriculture Education Doctoral Candidate

Appendix O

Letter to Agricultural Education Teachers with Instructions and Survey Link

From: John K. Duke [mailto:jkduke@CLEMSON.EDU]
Sent: Wednesday, June 27, 2007 5:25 PM
To: chetbass@sampson.k12.nc.us; piedmontFFA@hotmail.com; chestejd@rss.k12.nc.us; mharris@clevelandcountyschools.org; akidd@randolph.k12.nc.us; murphyb@gcs.k12.nc.us; overcadm@rss.k12.nc.us; pat_pence@hotmail.com; jeansmith@lenior.k12.nc.us; walker@jonesnc.net; avoncano@transylvania.k12.nc.us; twarren@sampson.k12.nc.us; rwarren@clinton.k12.nc.us
Cc: jkduke@CLEMSON.EDU; tdbbns@CLEMSON.EDU
Subject: Dissertation Help

Ag Teachers

After a trial/error period with the survey format I'm ready for your input. Below I have listed the link to the survey. You will be asked to rate 100 standards/competencies as a High Priority, Moderate Priority, Low Priority, or Not a Priority. Please base your answers on the fact that adequate materials will be provided for you to effectively teach the standard/competencies. Once you press the submit button at the end of the survey you will not be able to go back and make any changes in the survey. The survey will take approximately 45 minutes to complete. All statements will start with the phrase **The Student Will Be Able To:** Question one asks for your FFA Chapter number. This number will be used for tracking proposes only for the study, if you don't have a chapter number please enter high school and state name.

http://www.clemson.edu/bb_survey_tool/tsnoauth.php?s=10036-f448d24f52c0bf6d539d3620baf3f7c9

Please respond by July 15,2007

Thank you for your time and consideration
Thanks John

John K. Duke
Agricultural Education Doctoral Candidate

Appendix P

Study of Meat Science Standards/Competencies for
Secondary Agricultural Education Written Version

Instructions: Directions: Rate each item using the following responses High priority, Moderate priority, Low priority, Not a priority.

These are stated as objectives each statement will start with

The student will be able to:Questions:

1) Please enter your FFA Chapter number in this location. This number is only used to contact those teachers that did not respond:
   _____

2) know the historical events that changed or modified the industry (refrigeration and "The Jungle")

q High priority q Moderate priority q Low priority q Not a priority

3) know the history of the meat packing industry, noting the changes from the NE states to the Central Plains (refrigeration, railroads, interstate highway systems, disassembly of carcass from Henry Ford assembly.

q High priority q Moderate priority q Low priority q Not a priority

4) show how American History and Meat Science are closely related.

q High priority q Moderate priority q Low priority q Not a priority.

5) observe the how and why the meat industry has evolved, including technological innovations, change in processing centers.

q High priority q Moderate priority q Low priority q Not a priority

6) observe the relative changes in consumer consumption of meat products over the past 100 years.

q High priority q Moderate priority q Low priority q Not a priority

7) know what caused these changes, and the history of meat consumption in various cultures around the world.

q High priority q Moderate priority q Low priority q Not a priority

8) recognize that meat helps determine the culture of the people.

q High priority q Moderate priority q Low priority q Not a priority

9) know what drives meat consumption as related to culture and how the industry fits or might fit in the future.

q High priority q Moderate priority q Low priority q Not a priority

10) keep daily log of meat cuts consumed, supermarket trip comes after retail cuts are known.

q High priority q Moderate priority q Low priority q Not a priority

11) identify retail cuts in meat counter and be able to determine, what cut you want to buy.

q High priority q Moderate priority q Low priority q Not a priority

12) identify products by label, species, cuts wholesale and retail, meat label components, case ready products, type of packaging.

q High priority q Moderate priority q Low priority q Not a priority

13) begin to know the movement of meat from farm to table.

q High priority q Moderate priority q Low priority q Not a priority

14) discuss findings of supermarket survey.

q High priority q Moderate priority q Low priority q Not a priority

15) report on findings of supermarket survey, research a topic in new technology/research in meat science for tenderness, juiciness, and flavor, ready to eat meats, heat and serve, and/or value added meat products (Flat-Iron steak).

q High priority q Moderate priority q Low priority q Not a priority

16) relate their ideas from supermarket study of meat and the consumer.

q High priority q Moderate priority q Low priority q Not a priority

17) process what they have learned from supermarket survey, and communicate their findings to others.

q High priority q Moderate priority q Low priority q Not a priority

18) know all factors affecting the animal body pre-harvest and how these factors affect the final product.

q High priority q Moderate priority q Low priority q Not a priority

19) observe how an animal is slaughtered, and what parts are removed from the animal during harvest.

q High priority q Moderate priority q Low priority q Not a priority

20) realize the science and art of meat animal harvest.

q High priority q Moderate priority q Low priority q Not a priority

21) know general terms of how animals are harvested and what factors relate to meat quality.

q High priority q Moderate priority q Low priority q Not a priority

22) explain the physiological changes in muscle color, and factors that affect these changes.

q High priority q Moderate priority q Low priority q Not a priority

23) describe the differences in color from beef, lamb and pork both smoked and fresh. They will also learn what PSE (Pale, Soft, and Exudative) meat look like as well as old and youthful.

q High priority q Moderate priority q Low priority q Not a priority

24) identify normal, superior and inferior color of meat, as it deals with retail identification, freshness, and quality.

q High priority q Moderate priority q Low priority q Not a priority

25) recognized and know changes in meat color.

q High priority q Moderate priority q Low priority q Not a priority

26) know how color is developed and why color is important.

q High priority q Moderate priority q Low priority q Not a priority

27) know the properties of fresh meat post-mortem and how these properties affect the final fresh meat product.

q High priority q Moderate priority q Low priority q Not a priority

28) identify those properties that will be readily accepted or rejected by consumers.

q High priority q Moderate priority q Low priority q Not a priority

29) know the importance of water holding capacity (WHC).

q High priority q Moderate priority q Low priority q Not a priority

30) know what factors influence fresh meat properties and how this relates to meat quality characteristics.

q High priority q Moderate priority q Low priority q Not a priority

31) cut carcasses into main wholesale cuts distinguishing between the high merchandizing valued middle-meats and other cuts.

q High priority q Moderate priority q Low priority q Not a priority

32) observe fabrication at a local processing plant.

q High priority q Moderate priority q Low priority q Not a priority

33) know the need for boxed product to fill large orders of special cuts.

q High priority q Moderate priority q Low priority q Not a priority

34) identify where retail cuts are found and validate carcass classes, and wholesale cuts to determine level of quality.

q High priority q Moderate priority q Low priority q Not a priority

35) identify meat cuts by species; name the wholesale cuts, including smoked products.

q High priority q Moderate priority q Low priority q Not a priority

36) identify common retail cuts of beef, pork, and lamb; validate classes of retail cuts from a consumer's perspective.

q High priority q Moderate priority q Low priority q Not a priority

37) begin to recognize individual retail cuts from the different wholesale cuts of a specific species.

q High priority q Moderate priority q Low priority q Not a priority

38) identify general retail cuts, anatomy of muscle and bone: where cuts originate.

q High priority q Moderate priority q Low priority q Not a priority

39) determine the age and marbling scores of swinging beef carcasses and correct quality grade.

q High priority q Moderate priority q Low priority q Not a priority

40) know beef USDA quality grades, determine inferior quality of pork, lamb, and the use of this information to validate classes of carcasses, wholesale and retail cuts.

q High priority q Moderate priority q Low priority q Not a priority

41) become familiar with these grades and their usefulness in pricing and acceptability of the product.

q High priority q Moderate priority q Low priority q Not a priority

42) determine quality grades, factors involved, what influences them, and why they are important.

q High priority q Moderate priority q Low priority q Not a priority

43) determine Preliminary Yield Grade (PYG).

q High priority q Moderate priority q Low priority q Not a priority

44) determine USDA beef yield grade, determine trimness and muscling of pork, and lamb. Use this information in the evaluation of carcass classes, wholesale and retail cuts.

q High priority q Moderate priority q Low priority q Not a priority

45) become familiar with the grades and their usefulness in pricing and acceptability of product at the wholesale level.

q High priority q Moderate priority q Low priority q Not a priority

46) determine yield grades, what influences them, and how to improve cutability.

q High priority q Moderate priority q Low priority q Not a priority

47) demonstrate the relative importance of sanitation in a meat facility, relay the importance of Standard Operating Procedures (SOP)) for daily sanitation operations, and inspection.

q High priority q Moderate priority q Low priority q Not a priority

48) know the proper cooking temperatures for meat.

q High priority q Moderate priority q Low priority q Not a priority

49) identify safe and unsafe sanitation practices.

q High priority q Moderate priority q Low priority q Not a priority

50) use sanitation principles in combination with meat micro to appreciate a clean environment.

q High priority q Moderate priority q Low priority q Not a priority

51) know the importance of sanitation and environment on various types of microorganisms and how the condition of the meat facility affects bacterial growth.

q High priority q Moderate priority q Low priority q Not a priority

52) know factors that affect microorganism contamination and growth.

q High priority q Moderate priority q Low priority q Not a priority.

53) realize the potential of any food hazard and ways to control.

q High priority q Moderate priority q Low priority q Not a priority.

54) know the microbiological threat to food safety of meat, what factors influence food safety and how to improve.

q High priority q Moderate priority q Low priority q Not a priority.

55) know the importance of USDA inspection in the US, convey why the Meat Inspection ACT was passed.

q High priority q Moderate priority q Low priority q Not a priority.

56) observe meat inspector at a processing plant.

q High priority q Moderate priority q Low priority q Not a priority.

57) discuss parts of a carcass a meat inspector will look at to determine wholesomeness.

q High priority q Moderate priority q Low priority q Not a priority.

58 know how meat inspection has evolved and relates to a safe and wholesome meat supply.

q High priority q Moderate priority q Low priority q Not a priority.

59) know the 7 majors of HACCP, who started this process and for what program.

q High priority q Moderate priority q Low priority q Not a priority.

60) know the principles of HACCP, but not develop a plan.

q High priority q Moderate priority q Low priority q Not a priority.

61) note that all personnel involved in the meat chain are indeed responsible for the safety of the food on the consumer's table.

q High priority q Moderate priority q Low priority q Not a priority.

62 know what HACCP is and what's involved in creating a HACCP plan without the development of an individual plan.

q High priority q Moderate priority q Low priority q Not a priority.

63 utilize the newest food pyramid to establish a healthy diet with all essential nutrients.

q High priority q Moderate priority q Low priority q Not a priority.

64) identify what the major food groups are and why meat is important to an individual's diet.

q High priority q Moderate priority q Low priority q Not a priority.

65) know the importance of meat in the human food supply.

q High priority q Moderate priority q Low priority q Not a priority.

66) know what constitutes the food groups, and how to follow the new food guide pyramid.

q High priority q Moderate priority q Low priority q Not a priority.

67) recite the relative composition of meat products, including protein, fat, minerals, vitamins, and any necessary elements that are not provided by other food stuff.

q High priority q Moderate priority q Low priority q Not a priority.

68) discuss the nutrient density of meat, and identify the major vitamins and minerals found in meat.

q High priority q Moderate priority q Low priority q Not a priority.

69) know the vast amount of nutrients that are in the hamburger and other meat products.

q High priority q Moderate priority q Low priority q Not a priority.

70) know the nutrient composition of meat and how meat fits into a wholesome healthy diet.

q High priority q Moderate priority q Low priority q Not a priority.

71) know the chemical properties and the changes that occur in smoked and cured products.

q High priority q Moderate priority q Low priority q Not a priority.

72) identify and discuss various chemicals, and why they are used.

q High priority q Moderate priority q Low priority q Not a priority.

73) know the basic principles of curing and smoking.

q High priority q Moderate priority q Low priority q Not a priority.

74) know the changes that occur during the process of curing and smoking.

q High priority q Moderate priority q Low priority q Not a priority.

75) differentiate between the origins of sausages from their names, observe the different ingredients used in various types of sausage and distinguish between the different types of casing.

q High priority q Moderate priority q Low priority q Not a priority.

76) discuss why we grind, smoke and cure meat.

q High priority q Moderate priority q Low priority q Not a priority.

77) become acquainted with the most important and largest groups of meat compounds.

q High priority q Moderate priority q Low priority q Not a priority.

78) know the major product forms, production process for sausage, an appreciation for casing types and process techniques utilized in sausage manufacturing.

q High priority q Moderate priority q Low priority q Not a priority.

79 know the importance of research to find or add value to products that were once considered of low value and to find niche markets.

q High priority q Moderate priority q Low priority q Not a priority.

80) identify and discuss ways to add value to carcasses and primal cuts by processing (ex. Flat-Iron steak).

q High priority q Moderate priority q Low priority q Not a priority.

81 know the importance of continued studies and research to obtain new products and new systems of selling meat products.

q High priority q Moderate priority q Low priority q Not a priority.

82) know the major processes involved with adding value to whole muscle and comminuted meat.

q High priority q Moderate priority q Low priority q Not a priority.

83) learn what variety meats are from the three species.

q High priority q Moderate priority q Low priority q Not a priority.

84) identify various edible by-products by sight, and discuss their uses.

q High priority q Moderate priority q Low priority q Not a priority.

85) see the great diversity that edible by-products bring to the meat food groups.

q High priority q Moderate priority q Low priority q Not a priority.

86) know the harvesting process and uses for animal by-products.

q High priority q Moderate priority q Low priority q Not a priority.

87) list and explain the various type of medical, health, beauty, aesthetic, and other products that come as by-products of the meat industry.

q High priority q Moderate priority q Low priority q Not a priority.

88) discuss the uses of inedible by-products.

q High priority q Moderate priority q Low priority q Not a priority.

89) become aware of the importance of inedible by-products.

q High priority q Moderate priority q Low priority q Not a priority.

90) know the harvest, processing and uses for major inedible by-products.

q High priority q Moderate priority q Low priority q Not a priority.

91) identify and differentiate various species, wholesale and retail cuts of meat; fresh, smoked or cured.

q High priority q Moderate priority q Low priority q Not a priority.

92) identify a variety of meats that come from different species and relate the importance of these cuts in terms of merchandizing.

q High priority q Moderate priority q Low priority q Not a priority.

93) identify retail cuts by species, primal cut, and retail names of beef, pork, and lamb.

q High priority q Moderate priority q Low priority q Not a priority.

94) determine cut identification, primal cut and species of origin for meat cuts.

q High priority q Moderate priority q Low priority q Not a priority.

95 calculate USDA Quality and Yield Grades of beef carcasses and know the concepts behind calculated muscling in pork, US Grades and how to calculate USDA Quality and Yield lamb carcasses.

q High priority q Moderate priority q Low priority q Not a priority.

96 calculate beef USDA Quality and Yield Grade, to within a third of a grade.

q High priority q Moderate priority q Low priority q Not a priority.

97) determine quality and yield grades for beef carcasses.

q High priority q Moderate priority q Low priority q Not a priority.

98) know the placing criteria for the different cuts in the contest.

q High priority q Moderate priority q Low priority q Not a priority.

99) validate beef, pork, and lamb carcasses, primal and retail cuts.

q High priority q Moderate priority q Low priority q Not a priority.

100) know consumer decision making.

q High priority q Moderate priority q Low priority q Not a priority.

101 develop problem solving skills by determining value of meat carcass or cut's classes.

q High priority q Moderate priority q Low priority q Not a priority.

Appendix Q

CDC Reports: Investigation of Multistate Outbreak of E.coli0157:H7 Infection, Updated July 18, 2008

CDC's OutbreakNet Team conducted a multi-state case-control study in collaboration with health authorities in Ohio and Michigan to epidemiologically (the branch of medical science concerned with the occurrence and control of disease in populations) examine exposures that might be related to illness. The data indicate a significant association between illness and eating ground beef purchased at one of several Kroger® stores in Michigan and Ohio. CDC has provided these results to USDA-FSIS and public health agencies in Michigan and Ohio.

On June 25, 2008, a recall was announced for ground beef sold at Kroger® Co. Stores in Michigan and Ohio. On July 3, the Kroger® Co. expanded the June 25th recall to include ground beef products from Kroger® establishments outside of Michigan and Ohio. On June 30, 2008, a recall of 531,707 pounds of ground beef components from Nebraska Beef Ltd. was announced. On July 3, 2008, Nebraska Beef Ltd. expanded the June 30 recall to include all beef manufacturing trimmings and other products intended for use in raw ground beef produced between May 16 and June 26, 2008 totaling approximately 5.3 million pounds. More information about these recalls can be found at the United States Department of Agriculture, Food Safety and Inspection Service (USDA/FSIS) web site at http://www.fsis.usda.gov/fsis_Recalls/. FSIS has confirmed that none of the affected products remain available for purchase at stores; however consumers are urged to check their refrigerators and freezers and discard or return the ground beef products for a refund."

http://www.cdc.gov/ecoli/june2008outbreak/index_071608.html

Appendix R

Duplicate or Similar Standards and Those That Were Not Clear from Appendix K

1. list scientific names of major classes of livestock and where domesticated.
2. determine what animals are commonly viewed as sacred.
3. determine how animals are used
4. understand and contemplate the social status of consuming meat in the US or abroad, and understand the categories of meat products.
5. identify items available to consumer.
6. understand how meat is packaged, prepared and marketed. Furthermore, students would also learn about technologies to improve shelf-life and saleability and why these are important.
7. describe how a carcass is slaughtered, and what parts are removed from the animal during harvest.
8. understand humane slaughter.
9. understand the factors that affect color.
10. recognize and elaborate upon the many properties of meat.
11. relay the relative importance of boxed beef, and why this type of processing was introduced in the US.
12. identify major wholesale cuts.
13. become acquainted with carcass, wholesale cuts and shipment.
14. understand what are the wholesale cuts and where found on the carcasses.
15. distinguish between the many factors effecting retail cuts.
16. identify major retail cuts of meat.
17. differentiate between youthful and mature carcasses in the USDA grading systems.
18. know the factors associated with grade application.
19. estimate fat thickness at the 12^{th} rib, square inches of Rib Eye Area(REA), Kidney Pelvic and Heart fat (KPH) and Hot Carcass Weight (HCW). Will use these factors to determine the final Yield Grade(YG).

20. associate factors used with grade application
21. appreciate a clean environment at all times
22. understand standard sanitation, SOP, and General Manufacturing Procedures(GMP) operations, why they are important and how they fit into the regulatory environment.
23. discuss various microorganisms, in what products are they a danger in, and how to kill them.
24. understand purpose of inspection.
25. recognize the government program of meat inspection and how this controls food safety.
26. develop a HACCP plan for a small meat facility.
27. discuss the segments of HACCP.
28. understand the role of meat in the diet
29. understand the origins of, why and how meat is cured and smoked.
30. understand the basic principles of manufacturing.
31. understand how meat is packaged and merchandized.
32. list various types of edible products that can come from by-products of a processing facility.
33. aware of various edible by-products.
34. see the great value that animal harvest presents to society in addition to food.
35. understand application of class information.
36. validate four exhibits of beef, pork, and lamb, and rank these due to quality, muscling and trimness by criteria set forth by meat animal merchandizing in the United States or aboard.

Appendix S

Topics Removed from Appendix J

Topics not bulleted were not removed used for clarity.

- Meat and World Hunger

Overview of FFA Career Development Events

MEATS

- Written
- POULTRY
- Class Placing
- Quality grades
- Eggs
- Further processing

Appendix T

Definitions and Explanations of Topics in Table 2

Visit to Supermarket- Students are to visit a local supermarket meat counter observe the different meat cuts and meat products and talk to the butcher to learn his/her observation on meat.

Retail Cuts- Identification of the different meat cuts and origin of primal cut and specie.

Harvest- the process of converting the live animal to a carcass for further processing.

Sanitation, (SOP, GMP) - is the overall cleanliness of a meat processing area (meat plant. meat counter), SOP (Standard Operating Procedures) and GMP (General Maintenance Procedures) are written statement that give explicit information and guidelines on meat plant and meat equipment for total cleaning, antibacterial and total sanitation.

Microbiology, Meat as Culture – that meat is a good haven for the growth of bacteria, so the students need to understand why cleanliness in dealing with meat products is so important.

Quality Grade- all factors concerned with the quality grade of carcasses which estimate acceptability.

Color- factors dealing with the different colors of meat and the importance of each color to the quality of the meat product.

Yield Grade- All factors concerned with yield grade of the carcass which estimate amount of lean meat.

Class Placing of Meat – know placing criteria of different cuts, consumer decision making, and problem solving skills by placing four cuts in a class of products.

Fresh Meat Properties – properties of fresh meat post-mortem and how these properties affect the final fresh meat product including those that will cause a meat product to be accepted or rejected by the inspection service and/or the consumer.

Grading of Meat- calculating USDA Yield grades and to determine USDA Quality grades in beef, lamb, and pork carcasses.

Identification of Meat – this covers all meat products from cured products to fresh cuts through out all primal cuts and species of origin.

Meat as a Part of Culture- this covers how meat has changed throughout human culture and how meat has changed human culture.

Food Groups - use the newest food pyramid to establish a healthy diet with all essential nutrients and understand why meat is a important group in an individual's diet.

Inedible By-products – products not used in human food change, used in other parts of human culture: medical, health, beauty, aesthetic industries.

Fabrication – cutting meat animal carcasses into main wholesale/primal cuts then further processed into retail cuts.

Inspection – official USDA inspection service or State regulated inspection of meat processing plants.

Hazard Analysis of Critical Control Points (HACCP) – allows for the plant to establish critical control points throughout a processing line to set up check points and to establish breaking points in the line to minimize product recall.

Nutrition of Meat – composition of meat products, including protein, fat, minerals, vitamins, and any necessary elements not provided by other food stuff and how this affects your diet.

Edible By-Products – are also referred to as specialty meats consisting of the liver, heart, kidneys and other internal organs of the meat animal used for human consumption.

History – covers the significant changes in the development of the meat industry in the United States from New England "The Jungle" area in Chicago to the Mid West and the correlation of meat consumption to the history of the world.

Report of Survey to Class – Students present what they learned from their visit to the supermarket meat counter.

Value Added Processing – understanding the research and investment of increasing the value of cheaper meat cuts into more profitable products from different retail cuts to marinade or further processed products.

Sausage – inclusive to cover all sausage processing from fresh pork sausage, and ground beef to fermented sausage and bologna, wieners and all ground products.

Curing and Smoking – understand the chemical properties and the changes that occur in smoked and cured products. Including the principles of curing and smoking and identify the chemicals used and why they are diseriable.

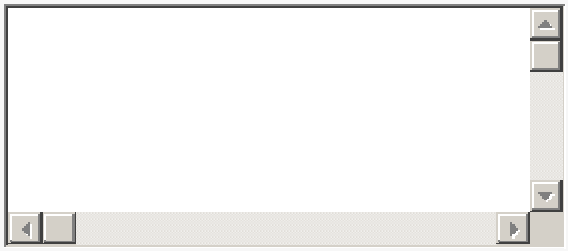
Appendix U

Study of Meat Science Standards/Competencies for
Secondary Agricultural Education On-line Version

Instructions: Please indicate the level of priority you would assign to each statement regarding the proposed meat science standards. Each statement will begin with the phrase **"The Student will be able to..."**

Questions:

1) Please enter your FFA Chapter number in this location. This number is only used to contact those teachers that did not respond:



2) know the historical events that changed or modified the industry (refrigeration and "The Jungle")

3) know the history of the meat packing industry, noting the changes from the NE states to the Central Plains (refrigeration, railroads, interstate highway systems, disassembly of carcass from Henry Ford assembly.

4) show how American History and Meat Science are closely related.

5) observe the how and why the meat industry has evolved, including technological innovations, change in processing centers.

6) observe the relative changes in consumer consumption of meat products over the past 100 years.

7) know what caused these changes, and the history of meat consumption in various cultures around the world.

8) recognize that meat helps determine the culture of the people.

9) know what drives meat consumption as related to culture and how the industry fits and might fit in the future.

10) keep daily log of meat cuts consumed, supermarket trip comes after retail cuts are known.

11) identify retail cuts in meat counter and be able to determine, what cut you want to buy.

12) identify products by label, species, cuts wholesale and retail, meat label components, case ready products, type of packaging.

13) begin to know the movement of meat from farm to table.

14) discuss findings of supermarket survey.

15) report on findings of supermarket survey, research a topic in new technology/research in meat science for tenderness, juiciness, flavor, ready to eat meats, heat and serve, and/or value added meat products. (Flat-Iron steak)

16) relate their ideas from supermarket study of meat and the consumer.

17) process what they have learned and communicate their findings to others.

18) know all factors affecting the animal body pre-harvest and how these factors affect the final product.

19) describe how a carcass is slaughtered, and what parts are removed from the animal during harvest.

20) realize the science and art of meat animal harvest.

21) know general terms of how animals are harvested and what factors relate to meat quality.

22) explain the physiological changes in muscle color, and factors that affect these changes.

23) describe the differences in color from beef, lamb and pork both smoked and fresh. They will also learn what PSE (Pale, Soft, and Exudative) meat look like as well as old and youthful.

24) identify normal, superior and inferior color of meat, as it deals with retail identification, freshness, and quality.

25) recognized and know changes in meat color.

26) know how color is developed and why color is important.

27) know the properties of fresh meat post-mortem and how these properties affect the final fresh meat product.

28) identify those properties that will be readily accepted or rejected by consumers.

29) know the importance of water holding capacity (WHC).

30) determine what factors influence fresh meat properties and how this relates to meat quality characteristics.

31) cut carcasses into main wholesale cuts distinguishing between the high merchandizing valued middle-meats and other cuts.

32) observe fabrication at a local processing plant.

33) know the need for boxed product to fill large orders of special cuts.

34) identify where retail cuts are found and validate carcass classes, and wholesale cuts to determine level of quality.

35) identify meat cuts by species, name the wholesale cuts, including smoked products.

36) identify common retail cuts of beef, pork, and lamb; validate classes of retail cuts from a consumer's perspective.

37) begin to recognize individual retail cuts from the different wholesale cuts of a specific species.

38) identify general retail cuts, anatomy of muscle and bone: where cuts originate.

39) determine the age and marbling scores of swinging beef carcasses and correct quality grade.

40) know beef USDA quality grades, determine inferior quality of pork, lamb, and the use of this information to validate classes of carcasses, wholesale and retail cuts.

41) become familiar with these grades and their usefulness in pricing and acceptability of the product.

42) determine quality grades, factors involved, what influences them, and why they are important.

43) determine Preliminary Yield Grade (PYG).

44) determine USDA beef yield grade, trimness and muscling of pork, and lamb. Use this information in the evaluation of carcass classes, wholesale and retail cuts.

45) become familiar with the grades and their usefulness in pricing and acceptability of product at the wholesale level.

46) determine yield grades, what influences them, and how to improve cutability.

47) demonstrate the relative importance of sanitation in a meat facility, relay the importance of Standard Operating Procedures (SOP)) for daily sanitation operations, and inspection.

48) know the proper cooking temperatures for meat.

49) identify safe and unsafe sanitation practices.

50) use sanitation principles in combination with meat micro to appreciate a clean environment.

51) know the importance of sanitation and environment on various types of microorganisms and how the condition of the meat facility affects bacterial growth.

52) know factors that affect microorganism contamination and growth.

53) realize the potential of any food hazard and ways to control.

54) know the microbiological threat to food safety of meat, what factors influence food safety and how to improve.

55) know the importance of USDA inspection in the US, convey why the Meat Inspection ACT was passed.

56) observe meat inspector at a processing plant.

57) discuss parts of a carcass a meat inspector will look at to determine wholesomeness.

58) know how meat inspection has evolved and relates to a safe and wholesome meat supply.

59) know the 7 majors of HACCP, who started this process and for what program.

60) know the principles of HACCP, but not develop a plan.

61) note that all personnel involved in the meat chain are indeed responsible for the safety of the food on the consumer's table.

62) know what HACCP is and what's involved in creating a HACCP plan without the development of an individual plan.

63) utilized the newest food pyramid to establish a healthy diet with all essential nutrients.

64) identify what the major food groups are and why meat is important to an individual's diet.

65) know the importance of meat in the human food supply.

66) know what constitutes the food groups, and how to follow the new food guide pyramid.

67) recite the relative composition of meat products, including protein, fat, minerals, vitamins, and any necessary elements that are not provided by other food stuff.

68) discuss the nutrient density of meat, and identify the major vitamins and minerals found in meat.

69) know the vast amount of nutrients that are in the hamburger and other meat products.

70) know the nutrient composition of meat and how meat fits into a wholesome healthy diet.

71) know the chemical properties and the changes that occur in smoked and cured products.

72) identify and discuss various chemicals, and why they are used.

73) know the basic principles of curing and smoking.

74) process of curing and smoking.

75) differentiate between the origins of sausages from their names, observe the different ingredients used in various types of sausage and distinguish between the different types of casing.

76) discuss why we grind, smoke and cure meat.

77) become acquainted with the most important and largest groups of meat compounds.

78) know the major product forms and production process for sausage and an appreciation for casing types and process techniques utilized in sausage manufacturing.

79) know the importance of research to find or add value to products that were once considered of low value and to find niche markets.

80) identify and discuss ways to add value to carcasses and primal cuts by processing (ex. Flat-Iron steak).

81) know the importance of continued studies and research to obtain new products and new systems of selling meat products.

82) know the major processes involved with adding value to whole muscle and comminuted meat.

83) learn what variety meats are from the three species.

84) identify various edible by-products by sight, and discuss their uses.

85) see the great diversity that edible by-products bring to the meat food groups.

86) know the harvesting process and uses for animal by-products.

87) list and explain the various type of medical, health, beauty, aesthetic, and other products that come as by-products of the meat industry.

88) discuss the uses of inedible by-products.

89) become aware of the importance of inedible by-products.

90) know the harvest, processing and uses for major inedible by-products.

91) identify and differentiate various species, wholesale and retail cuts of meat; fresh, smoked or cured.

92) identify a variety of meats that come from different species and relate the importance of these cuts in terms of merchandizing.

93) identify retail cuts by species, primal cut, and retail names of beef, pork, and lamb.

94) determine cut identification, primal cut and species of origin for meat cuts.

95) calculate USDA Quality and Yield Grades of beef carcasses and know the concepts behind calculated muscling in pork, US Grades and how to calculate USDA Quality and Yield lamb carcasses.

96) calculate beef USDA Quality and Yield Grade, to within a third of a grade.

97) determine quality and yield grades for beef carcasses.

98) know the placing criteria for the different cuts in the contest.

99) validate beef, pork, and lamb carcasses, primal and retail cuts.

100) know consumer decision making.

101) develop problem solving skills by determining value of meat carcass or cut's classes.

Appendix V

Input on Topics from Dr. Melvin Hunt and Other
Kansas State University Meat Science Faculty

July 27, 2005

From: Melvin Hunt (with input from others)

John:

You have a very tough job of trying to figure out just what to do. I polled our group and the major comment was that your current list is very good, but quite traditional (and probably too much detail for secondary educ). They did suggest another order of topics (see attached sheet). Please note that there is about 2 zillion ways to put this together and what I send you is only a "general consensus" of 5 people.

For your consideration, they suggested a slightly different approach that might fit into a high school curriculum. Something like:

Role of Meat in the Human Diet
- What is in meat?
- Nutritive value of meat
- Ethnic meat products
- Muscle foods and Global Nutrition

Safety of Meat Products
- Add your subtopics of HACCP and Inspection

Where does Meat Come From?
- Livestock and Meat (grading etc.)
- Harvest
- If used, put by-products in here

Meat Processing Basics
- Little bit on Meat Chemistry, rigor, pH, etc.
- Properties of Meat
- Fab and packaging
- Value-added Meat
  - Enhancing, curing, sausage, preservation.

Major Topics of Basic Meat Science Curriculum

1. History of Meat Science		1
2. Supermarket Survey		3
3. Overview of Livestock and Meat Industry		2
4. Conversion of Muscle to Meat		6
a. pH effect on rigor		
b. pre and post mortem effects		
5. Meat and the Diet		11
6. Food Safety		10
a. HACCP	C	
b. Inspection	D	
c. Microbes	A	
d. SSOPS, GMP	B	
7. Meat Curing and Smoking		9 Value-added Meat Processing (combine curing, saus, preservations)
8. Sausage Manufacturing		
9. USDA Grades of Livestock		4
a. Quality		
b. Yield		
10. Fresh Meat Properties		8
11. Meat Preservation		
12. By-Products		12
13. Fabrication		7
14. Harvest		5

Appendix W

Removed standards with Mean < 2.5 or Standard Deviation > 1.0

9	keep daily logs of meat cuts consumed. Supermarket trip comes after retail cuts are known;	2.48	0.87
55	observe meat inspector at a processing plant;	2.75	1.01
58	know the seven major points of HACCP, who started this process, and for what program;	2.71	1.04

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