
Revision of the Animal Science Curriculum: Responding to Students, Industry Changes and Evolving University Guidelines

David S. Buchanan, Charles A. Hibberd, J. Robert Kropp and W. Stephen Damron

Abstract

Change in an Animal Science curriculum occurs with input from many sources outside the departmental faculty. Changing student demographics, industry needs and a university's view toward core curricular matters are contributors to change. The department must absorb these inputs and design plans of study that (1) meet the needs of students (2) are flexible, and (3) maintain appropriate rigor. This department responded by designing nine different options that are quite distinct from one another. Each option has a specific target audience. Flexibility is maintained within an option through choices in controlled electives and through appropriate substitutions.

Introduction

Woodrow Wilson, while president of Columbia University, commented that "the process of changing a college curriculum may be as difficult as moving a graveyard." While the barriers to change are very substantial, the signals are increasingly clear that changes are necessary. It has been suggested that "the Land-Grant Universities have lost their way" (Schuh, 1986). Further, it has been said that "a radical rethinking of the mission, need and approach to the undergraduate curriculum in agriculture is needed" (Kunkel, 1992). These challenges resonate with the ongoing input from our students, alumni, clientele and colleagues from other parts of the campus to design curricula that are relevant, flexible, challenging and contribute to both the breadth and depth of knowledge and understanding in our graduates.

The legislation that created the land-grant philosophy (Morrill Act, 1862; Hatch Act, 1887; Smith-Lever Act, 1914) has been among the most successful legislation ever passed

by the U.S. Congress. The requirement in the Morrill Act to "provide a liberal and practical education to the industrial classes" remains as vital today as it did in 1862. We do need to recognize that there have been numerous cultural changes in the intervening time. Increase in efficiency and scope of agricultural production has contributed to a revolution in the way that the citizens of this country live. The vast majority of our population is not dependent upon food or fiber that they produce for themselves. The general safety of our food supply is excellent, despite isolated problems that attract much media attention. In addition, U.S. Agriculture provides food for many other parts of the world.

These successes have contributed to the situation that now faces the Land-Grant Universities. The traditional base of students represents a smaller component of our society. While agriculture is efficient and produces products that are reasonable in price, the consumer is frequently the main beneficiary and not all producers reap the economic benefits of advances in technology. This, at times, contributes to tough economic times in segments of American agriculture causing some parents to encourage their children to pursue careers outside agriculture. In addition, people involved in the agricultural production sector have recognized their diminishing political importance as fewer congressional districts are predominantly agricultural areas. The result is that these people tend to become more protective of traditional land-grant university activities which can, at times, inhibit pursuit of new opportunities.

Land-Grant universities have not responded quickly to the changing cultural and political landscape (Meyer, 1993). Mixed signals from agribusiness, students, alumni and university administrations contribute to this inertia. The generally conservative nature of agriculture faculty coupled with a desire to train students in our own image may also contribute. Nonetheless, the factors dictating change are unmistakable. While the number of career opportunities in production agriculture is decreasing, the number of graduates needed in jobs that support production agriculture is increasing (Coulter et al, 1990). Many states are at a low point in the number of high school graduates and will not begin increasing until the end of the decade. Competition from junior colleges and other four year colleges is increasing because of differential changes in entrance requirements and tuition costs in many states. The number of non-traditional students with an interest in agriculture courses is also increasing. Finally, and perhaps

Buchanan and Kropp are professors and Damron is associate professor in the Department of Animal Science, College of Agricultural Sciences and Natural Resources, Oklahoma State University, Stillwater, OK 74078. Hibberd is Director, Panhandle Research and Extension Center, University of Nebraska, Scottsbluff, Nebraska, 39361.

From a presentation given in the symposium "Developing Animal Science Curricula to Service Future Needs" at the 1993 Annual Meeting of the American Society of Animal Science, Spokane, WA.

most critically, the need for visionary leaders in agriculture has seldom been greater and land-grant universities have a major responsibility in educating such leaders.

The Animal Science Department at Oklahoma State University has tried to stay ahead of the curve in curriculum development over the last decade. We have experienced successes and failures in this effort, but our experiences may be instructive. We will attempt to describe our efforts, and the driving philosophies behind those efforts, in this paper.

The Setting in 1982

There were 569 Animal Science majors at Oklahoma State University in the Fall of 1982 (Table 1). During the previous decade, the total number of students had exceeded 600 at times. By the fall of 1986, this number had dropped to 432. The reasons for this decline were numerous. The economy of Oklahoma suffered a severe downturn due to changes in both the petroleum and agriculture industries and this economic change was, no doubt, a major factor.

Prior to 1982, the Animal Science Department sponsored 6 options (plans of study). Three of these options were fairly traditional Production, Science and Business options. The department also had a Pre-Veterinary Science option for the benefit of students preparing for the College of Veterinary Medicine, a Food Industry option for students planning on careers in the food industry and an Animal Science-Ag Education Double Major for students interested in teaching Agriculture at the high school level. The Pre-Veterinary Science option included all of the general requirements for a B.S. degree, the specific requirements for admittance to the OSU College of Veterinary Medicine and a small number of additional Animal Science classes. The first year in the College of Veterinary Medicine replaced the senior year in Animal Science. The Food Industry option was centered on courses in the areas of meat and dairy products, but graduates from the option have opportunities with numerous other types of foods as well. The double major with Ag Education was essentially a combination of the Production option with the Ag Education requirements to earn a teaching certificate.

The Production, Science and Business options were quite similar. Requirements differed by approximately 20 credits (Table 2). By 1982, new options in Ranch Operations and Livestock Merchandising were introduced. The Ranch Operations option was a revision of the Production option with more emphasis on range and grass management. The Livestock Merchandising option was a revision of the Business option with additional requirements in advertising, journalism and

public relations. The various requirements among the options were still quite uniform (Table 2).

Input from Various Sources

Declines in enrollment encouraged listening to many voices with concerns about the curriculum. Informal surveys of students in Introductory Animal Science illustrated that the number of students planning on careers in agriculture production was declining. Parents of potential students were expressing concerns about the amount of business training available to students with majors in Animal Science. This concern was reinforced later through a study that examined the characteristics of the ideal agriculture graduate (Helmig, 1989). Several curriculum studies pointed out the need to include more emphasis on values, ethics, history, problem solving, interpersonal relations, reading, critical thinking and cross-cultural understanding (Carnegie, 1981; Northeast, 1982; Bennett, 1984; Mortimer, 1981; American Colleges, 1985 and review of these studies in Sledge, 1987).

The OSU Animal Science Department has an ongoing program of advisory committees from the industry. More emphasis on business, range and forage management and journalism were mentioned by committees as desirable characteristics of some, though not necessarily all, graduates.

A consensus was developing at OSU, at about this same time, to have a set of General Education Requirements. The first set of requirements established guidelines for several general areas (communications, natural sciences, mathematics, social sciences, humanities and international dimension). These first requirements dictated relatively little change in Animal Science requirements because the curriculum was already quite broad based.

Revising the Options

In 1987, the department decided to create distinct differences among the options. The Business option was revised substantially to include more specific requirements in Agricultural Economics and from the College of Business Administration. Students could take as many as 49 credits (out of a total requirement of 130) in courses with a primary business emphasis. A minor in Business was fairly easy to accomplish. A new Animal Biotechnology option replaced the Science option and included more Chemistry, Physics and Biology and opportunities to take a variety of upper division science based courses from the College of Arts and Sciences. A minor in Chemistry was possible within the framework of the Bio-

Table 1. Number of undergraduate Animal Science majors at Oklahoma State University (1982-1992)

	Year										
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Students	569	533	560	499	432	487	540	556	538	517	526

Table 2. Undergraduate curriculum options^a in Animal Science at Oklahoma State University in 1982

	Number of Credits							
	Production	Business	Science	Ranch Operations	Livestock Merchandising	Pre-Veterinary Science	Ag Education Double Major	Food Industry
Communications	9	9	9	9	9	9	9	9
Biological Science	12	12	14	10	12	12	13	11
Chemistry & Physics	12	12	16	12	12	27	12	12
Math & Statistics	3	3	5	3	3	3	3	3
History & Political Science	6	6	6	6	6	6	6	6
Social Sciences	0	0	0	0	0	0	3	0
Humanities	3	3	3	3	3	3	3	3
Computers	0	0	0	0	0	0	0	0
International	3	3	3	3	3	3	3	3
Animal Science	41	39	39	39	43	23	38	34-37
Agronomy	11	4	4	15	4	0	11	4
Agricultural Economics	7	7	7	7	4	4	10	4-7
Mechanized Agriculture	2	0	0	0	0	0	7	0
Business	0	9	0	0	0	0	0	6-12
Journalism & Broadcasting	0	0	0	0	3	0	0	0
Controlled Electives	9	12	12	6	20	43 ^b	9	15
Animal Science	0-9	0-6	0-6	0-6	0-7	0	0	0-15
Agronomy	0-9	0	0-9	0-6	0	0	0	0
Ag Economics	0-9	0-12	0	0-6	0-3	0	0	0-6
Mechanized Agriculture	0	0	0	0	0	0	3	0
Business	0-6	0-12	0	0	0-13	0	0	0-15
Journ & Broad	0	0-6	0	0	7-11	0	0	0-9
Math & Science	0-6	0-6	0-12	0-3	0	0	0	0-15
Education	0	0	0	0	0	0	6	
Free Electives	11	13	14	12	10	0	0	16

^a all options include a total of 130 semester credits except the Ag Education Double Major which has 148 credits

^b these credits earned in the first three semesters in the College of Veterinary Medicine

technology requirements. The Livestock Merchandising option included 21 to 36 credits in Journalism and Broadcasting and allowed a minor in that field. The Ranch Operations option still included 21 to 33 credits in Agronomy and provided a good general background for students with an interest in extensive animal production. More recently, the Production option has been revised to include requirements in Agricultural Economics, Mechanized Agriculture and Agronomy that would contribute to a greater understanding of intensive animal production.

The Food Industry option continued to serve students planning on careers in that industry. The option emphasizes business and management aspects of the food industry. An opportunity to provide scholarships through the Institute of Food Technology lead to the creation of a Food Science option. This option is more appropriate for students desiring preparation for graduate school in Food Science.

The Pre-Veterinary Science option was revised to include a fourth year for students that did not enter the College of Veterinary Medicine after three undergraduate years. Prior to this time, most students had to switch to another option to complete the B.S. degree. The optional fourth year included additional courses in science and animal production.

During 1990 and 1991, the General Education requirements were changed and core curriculum requirements were established for all graduates in the College of Agriculture. These changes added 12 to 15 credits to the various options. These credits came at the expense of Animal Science and other Agriculture classes and electives.

There are nine options for Animal Science freshman that are currently enrolling for the fall semester of 1993 (Table 3). These options reflect all the changes that have been made over the last decade, some under the dictates of the Animal Science Department while other changes have been dictated by other administrative levels. The department continues to review these options to ensure that they meet the needs of our students.

Benefits and Concerns of Curricular Variety

The various options have been valuable recruiting tools. The number of undergraduate students in the Animal Science Department has remained over 500 since 1988. An interesting side note is that the department generally has students from at least 25 states, other than Oklahoma. Although it cannot be clearly determined, there is general consensus

that the recovery in student numbers was assisted by the new and revised options. The options can be presented as opportunities to prepare for a wider variety of careers. The first evidence is that the number of students in the Business option increased from approximately 10% to nearly 30% of Animal Science students. More Animal Science graduates are pursuing careers in business, sales and journalism. Animal Science graduates have pursued advanced degrees in Agricultural Economics, Business Administration, Law and Medicine as well as the more traditional advanced degrees in Animal Science, Food Science and Veterinary Medicine. Informal discussions with students that attend professional schools indicate satisfaction with the Animal Science curriculum as preparation for their continued education.

Whenever major changes occur, concerns arise and these changes in curricular requirements are no different in this regard. The diversity in options presents challenges in advising students, particularly those undecided in their career choice. A decision about which option to pursue must be made fairly early in the college career to prevent loss of credits. Advisors must be current in their knowledge of classes from numerous areas. Students that decide, late in their undergraduate career, to pursue graduate school in Animal Sci-

ence are often caught short of important courses in the basic sciences if they are not in the Biotechnology or Pre-Veterinary Science options. There is an ongoing concern about the basic integrity of the Animal Science major. Are we requiring all the classes that should, without exception, be part of an Animal Science curriculum?

The diverse options provide flexibility within an Animal Science major because the student starts with nine choices. Unfortunately, the options themselves are relatively rigid with few free electives. Provisions of flexibility are important, particularly for strong students that have diverse interests. The controlled electives, which provide much of the uniqueness among the options, do provide numerous choices within the options. In addition, the department tries to advise students in such a way that substitutions are encouraged, as long as the substitution represents a legitimate alternative of similar rigor.

The Animal Science Department has a large number of junior college transfer students. Approximately 65% of all Animal Science students are classified as juniors or seniors which reflects the large influx of students during the junior year. The diverse curriculum, and small numbers of free electives, present problems in advising junior college transfer

Table 3. Undergraduate curriculum options^a in Animal Science at Oklahoma State University in 1993

	Number of Credits								
	Production	Business	Animal Biotechnology	Ranch Operations	Livestock Merchandising	Pre-Veterinary Ag Education Science	Food Double Major	Food Industry	Food Science
Communications	12	12	12	12	12	12	12	12	12
Biological Science	7	4	15	4-8	4	11	11-16	8	8
Chemistry & Physics	5	5	24	10	5	26	5	10	21
Math & Statistics	6	6	6	6	6	6	6	6	8
History & Political Science	6	6	6	6	6	6	6	6	6
Social Sciences	3	3	3	3	3	3	3	3	3
Humanities	6	6	6	6	6	6	6	6	6
Computers	2	2	2	0	2	0	2	0	0
International	3	3	3	3	3	3	3	3	3
Animal Science	39	36	34	38-41	37	22	34	40	38
Agronomy	3	3	3	12-19	3	3	3-10	3	3
Agricultural Economics	10	16-22	4	7	4-7	4	10	4	4
Mechanized Agriculture	3	0	0	0	0	0	3-10	3	3
Education	0	0	0	0	0	0	26	0	0
Business	0	0-6	0	0	0-6	0	0	3	3
Journalism & Broadcasting	0	0	0	0	12-18	0	0	0	0
Controlled Electives	17	11	12	12	13	30 ^b	0	15	11
Animal Science	0-9	0-11	0-12	0-6	0-9	8-24	0	0-12	0-11
Agronomy	0-5	0-10	0	0-6	0	0-16	0	0	0
Ag Economics	0-3	0-12	0	0-6	0-12	0-16	0	0-9	0
Mechanized Agriculture	0-5	0	0	0	0	0	0	0	0
Business	0-3	0-12	0	0-6	0-12	0-3	0	0-15	0
Journ & Broad	0	0-9	0	0	0-12	0	0	0-6	0
Math & Science	0-4	0-11	0-12	0-10	0-4	0-16	0	0-12	0-11
Free Electives	5	5	4	5	5	6	0	9	4

^a all options include a total of 130 semester credits except the Ag Education Double Major which has 148 credits

^b these credits may be earned by completing all the required courses in the first year in the College of Veterinary Medicine

students since such students frequently have courses that do not fit into the desired plan of study. The department works closely with some of the primary sources of transfer students to ensure that advisors at those institutions are aware of our curriculum and can advise appropriately.

One feature of many of the options is that they represent plans of study and career opportunities that are substantially different from those experienced by the faculty when they were students. Many faculty members have had to come to grips with the fact that we are not training students in "our own image." There is an understandable tendency, among faculty members, to give more respect to courses in the sciences than to courses in business, journalism or other fields in agriculture. When viewed objectively, this does not represent a large problem, but it does represent an area that faculty members must reason through carefully.

General Education

The changes in the general education requirements have probably caused more frustration among faculty and students than any other. The feeling that it was imposed by a source that was beyond the control of the department contributes to the frustration as does the fact that the recent increase in requirements has inhibited the flexibility of the department in designing curricula.

Courses in Chemistry, Biology and Math do not create much tension since they are central to the understanding of Animal Science courses. Similarly, courses in English composition are readily accepted since writing is part of the every day experience of faculty members and it is easy to recognize writing deficiencies among the students. Social Sciences, the Humanities, additional technical writing and Speech and an International Dimension have met with more resistance. The centrality to courses in Animal Science is more difficult to draw and discomfort by students draws the sympathy of the faculty.

Faculty members often need to be more affirming when advising students to take General Education courses. Many curriculum reports emphasize the need for addressing values, ethics, history, writing, interpersonal relationships and an understanding of cultural issues (Carnegie, 1981; North-east, 1982; Bennett, 1984; Mortimer, 1981; American Colleges, 1985). A survey of agriculture employers indicated a need, not only for a greater understanding of business concepts, but also a broader world view, better interpersonal skills and enhanced communication abilities (Helming, 1989). While basic science courses contribute in obvious ways to understanding Animal Science principles, other general education areas also contribute to broader understanding. Increased need for the livestock and food industry to be involved in the political process suggests a need for understanding of history and government. International trade opportunities will be easier to understand with knowledge of other cultures and the social sciences. The social sciences also contribute to concepts of personnel management, marketing strategies and the need to work with local governments in establishing com-

munity-livestock industry partnerships. The arts contribute to the livestock industry in ways that may not be obvious, but are real none-the-less. As just two examples, the pleasure horse industry is heavily influenced by artistic expression and live animal evaluation is certainly affected by changing ideas about lines and symmetry.

Perhaps the most profound need for some understanding of social sciences and the humanities relates to the ways which society obtains information about animal agriculture. Music, art, motion pictures, television, literature and the theater each have numerous characterizations of elements of agriculture. Some are complimentary, others are not. Some are accurate, while others are highly misleading. A society, which is rapidly losing its collective memory of the farm, can acquire views of agriculture that lead to unwise public policy decisions unless individuals in the livestock and food industries develop understanding of those views and can successfully counteract negative perceptions.

In addition, there is truth in the idea that a college education should prepare students, not only to make a living, but also prepare them for life. Well-conceived plans for using general education can contribute to greater appreciation for varied life interests. This appreciation should not be discounted.

Where to Now?

The department is currently in the beginning stages of a university wide effort in assessment that may yield greater understanding of the success of the current options. Projections into the future are difficult because understanding of new opportunities is elusive. It seems clear that the general concepts of communication, quantitative understanding, basic science and interpersonal relationships will always be important in an Animal Science curriculum. There is hope that there will be few additional changes in General Education requirements although the possibility of increased emphasis on multiculturalism, gender issues and non-Western culture seems real. Ongoing discussion of the relative importance of various Animal Science, and other agricultural principles is critical. Caution must be exercised to be aware of student needs rather than protection of favored specialties. Opportunities to consolidate courses, or even delete courses also need to be examined. This streamlining would make advising easier and would assist students in progress toward degree completion. New opportunities for Animal Science graduates must be found and appropriate curricular innovations must be developed around those opportunities. Some of these opportunities may be in areas that do not fall within the traditional boundaries of Animal Science. Animal Science Departments will have to decide how to respond to such changes.

Implications

Each department must evaluate its unique characteristics before making major changes in the curriculum. There are many equally valid approaches to development of a curricu-

lum. The development of a large number of distinctly different options has been valuable as a recruiting tool and as a means of ensuring that each student has a curriculum that is both broad in scope and sufficiently specific to a desired career orientation.

References

- Association of American Colleges, 1985. *Integrity in the college curriculum: a report to the academic community*. Washington, D.C.
- Bennett, W. 1984. *To Reclaim a Legacy: Report on the Humanities in Higher Education*. Washington, D.C.: National Endowment for the Humanities.
- Boyer, E. 1981. *A quest for common learning*. Carnegie Foundation for the Advancement of Learning. Washington, D.C.
- Coulter, K.J., A.D. Goecker and M. Stanton. 1990. *Employment opportunities for college graduates in the Food and Agricultural Sciences*. Higher Education Programs, Cooperative State Research Service. U.S.D.A. Washington, D.C.
- Helming Group. 1989. *Searching for the ideal agriculture graduate: A survey of the agriculture, agribusiness and food industries*. College of Agriculture, University of Nevada, Reno.
- Kunkel, H.O. 1992. Overview. in Board of Agriculture, National Research Council. *Agriculture and the Undergraduate*. National Academy Press, Washington, D.C.
- Meyer, J.H. 1993. The stalemate in food and agricultural research, teaching and extension. *Science* 260:881.
- Mortimer, K. 1981. *Involvement in learning: realizing the potential of American higher education. Report of the study group on the condition of excellence in American education*. National Institute of Education. Washington, D.C.
- Northeast Higher Education Committee. 1982. *Securing Americans' food and agricultural resource base*.
- Schuh, G.E. 1986. Revitalizing Land Grant Universities: It's time to regain relevance. *Choices (Second Quarter, 1986)*:6.
- Sledge, G.W. 1987. Curricular Revitalization - A necessity. in NCR RICOP Curricular Committee. *Curricular Innovation for 2005 - Planning for the future of our Food and Agricultural Sciences*.

BOOK REVIEWS

Wayne L. Banwart, Book Review Editor
Department of Agronomy
University of Illinois, Urbana. IL 61801

The NACTA Journal Book Review policy encourages the academic freedom of peers in the constructive criticism of unsolicited books submitted by publishers for review. The peer reviewers are persons who teach and/or conduct research in the subject matter area in which the book is written. A given review expresses the opinion of only the reviewer, and does not necessarily reflect the opinions of NACTA and/or the NACTA Journal.

Impacts of Livestock Production on Society, Diet/Health and the Environment

Peter R. Cheeke
Interstate Publishers, Inc., 1993
256 pp. Paperbound \$27.95

This unique book deals with important issues that are affecting livestock production and the public perception of animal production. The book is broadly applicable to animal production on a global basis. Topics that are included are consumption of animal products and human health, competition between humans and animals for grains, biotechnology and its impacts on animal production, feed additives, hormones and other chemicals, livestock and global warming, tropical deforestation for cattle ranching, livestock grazing and desertification, impacts of livestock on wildlife, factory farming of animals, animal rights, other societal concerns, and the integration of livestock production into sustainable agriculture.

Chapter one discusses domestication of animals and their contributions to human welfare. This chapter covers the history of domestication from the beginnings of humankind and includes

discussions of species that may yet become domesticated. The author explains the historical interrelationships between man and animals. The author also expresses his own opinions regarding a loss of this understanding of this relationship as cultures become further removed from agriculture.

Chapter two presents rather in-depth discussions regarding animal products in the human diet. Topics include concerns about red meat, animal products and cardiovascular disease, diet and coronary heart disease, dietary fat and cancer, obesity and consumption of animal products, modification of animal products to improve human health, and vegetarianism. This chapter is not biased toward the promotion of animal products. The author has provided full explanations of some of the problems associated with the consumption of animal products. He also refers readers to review articles for additional information. Some livestock producers may not like everything they read in this chapter, but the author has carefully gathered literature about some of the problems associated with consumption of some animal products. When one reads the chapter with an open mind, the author's interpretations appear to be accurate.

Chapter three asks the question, "Do livestock compete with humans for food resources?" The author addresses this question in a rather common sense manner. He presents his insights in such a way that it would be difficult to fault his reasoning.

Chapter four discusses principles of animal nutrition and the scientific feeding of livestock. This is an excellent chapter although some may argue whether this chapter actually fits into this book. The chapter is not particularly different from one that might be found in a feeds and feeding text. It is the author's opinion that it is necessary to understand the various digestive processes and nutrients in order to evaluate the ecological and environmental effects of livestock and to lead into a discussion of feed additives. Animal science students using this book will find that this chapter is little more than review of material covered in nutrition courses. Non-animal science readers will gain much