

What Skills Do Graduates Need?

Andrew P. Barkley

Abstract

Survey data collected from graduates of the College of Agriculture at Kansas State University from 1978 to 1988 were utilized to determine what skills were important to agriculture alumni in their current employment. The statistical relationships between the graduates' major field of study and the relative importance of selected career skills are presented and discussed. Oral communication skills and

people skills were the most important for a large percentage of agriculture graduates. There was wide divergence in the relative importance of skills for different fields of study.

Employment opportunities within the agricultural sector are changing at a rapid pace. Production agriculture has become increasingly complex, requiring sophisticated management and analytical skills for competent decision-making. Technological advances and economic growth have increased the demand for agriculture graduates in the processing, marketing, and distribution of food products (Coulter, Stanton, and Goecker). Given these ongoing developments, agricultural curricula must accommodate the changing needs of agriculture graduates and their employers.

Students enrolled in agriculture often demand relevance to the "real world." What could be more relevant than knowledge of the skills that former agriculture students use while on the job? The experiences of recent graduates can be used to enhance course planning and evaluation, curricula development, and student advising. A recent alumni survey conducted by Byler and Lamberth indicated that the most frequently cited need for improvement in agricultural curricula among graduates of the Tennessee Technological University School of Agriculture was "more emphasis on career guidance and placement." Students currently enrolled in agricultural programs can benefit from knowledge of the post-commencement experiences of recent graduates by building skills that alumni found useful in agricultural careers. Teachers can contribute to the potential productivity and career satisfaction of currently enrolled students by incorporating the views of former students into both classroom instruction and career advising.

Previous studies of desired career skills and interpersonal characteristics in the agricultural sector are of two types: surveys of employers and surveys of alumni. Broder and Houston surveyed both agribusiness firms and University of Georgia alumni to provide "documentation of employer needs and perceptions." Morrison and Edwards asked agribusiness employers to identify characteristics associated with successful employment in agribusiness. Litzenberg and Schneider provided results of a national survey of agribusiness firms that ranked the desirability of a large number of personal characteristics.

Alumni surveys include that of Byler and Lamberth, who documented curricula revisions at Tennessee Technological University, implemented in part as a result of follow-up surveys of School of Agriculture alumni. Riesenbergh also employed an alumni survey to determine student perceptions. Barkley is an assistant professor in the Department of Agricultural Economics, Kansas State University, Manhattan, Kansas 66506.

Cadle (continued from previous page).

lectured concepts, alone, he or she is more apt to gain interest and possibly pursue the field. The surrounding community is often an overlooked source of needed equipment and livestock. Because of its diversity, this source may even prove to be more effective than institutionally owned facilities.

Table 1. Lecture And Laboratory For Beginning Animal Science

Lecture	Laboratory
Reproduction	
Anatomy of male and female reproductive tracts	Dissect open and pregnant bovine reproductive tracts
Hormones of reproduction	
Introduction to artificial insemination and pregnancy diagnosis	Observe cows in heat at a dairy
Reproductive diseases	Semen collection and evaluation
Nutrition	
Digestive system of monogastric farm animals	Dissect monogastric digestive system
Digestive system of ruminant farm animals	Dissect ruminant digestive system
Nutrients	Tours of feed mills
Swine Production	
History	Swine judging
Breeds of swine	Tours of swine operations
Management practices	
Sheep Production	
History	Tour of sheep ranch
Breeds of sheep	Tour of wool warehouse
Management practices	Wool judging
Wool production and evaluation	
Cattle Production	
History	Tours of commercial and registered cow operations and feedlots
Breeds of cattle	
Management practices	
Horse Production	
History	
Types and breeds of horses	Tour of horse ranch
Management practices	Tour of breeding farm
Common ailments of horses	
Marketing of Farm Animals	
Markets	
Carcass evaluation	Tour of slaughter plant
Wholesale and retail cuts	

of the future direction of the College of Agriculture curricula at the University of Idaho.

The purpose of this study is to provide further information on career skills used by former students of agriculture at Kansas State University. Specific objectives are (1) to determine what skills are important to graduates in their present occupation and (2) to determine differences in the importance of skills across major fields of study. This study contributes to the literature by employing a large number of observations (n=1539) to analyze the importance of selected skills for both all survey respondents and graduates of each field of study within the College of Agriculture.

Survey and Data

The data utilized in this research were collected from a recent (August 1989) mailed survey of alumni of the College of Agriculture at Kansas State University from 1978 to 1988. Questionnaires were mailed to the 5023 graduates with mailable addresses identified by the K.S.U. Alumni Association. Usable survey instruments were returned by 1539 graduates, yielding a response rate of more than 30%. Financial support for the survey was provided by a grant from the Agricultural Alumni Association.

All major fields of study were represented in the sample, with Animal Sciences and Industry being the most frequent (table 1). Other well-represented majors included Agricultural Economics, Agronomy, Horticulture, and Agricultural Education. Graduates of all degree programs were represented, and more than 32% of the respondents had an advanced degree; 16% earned an M.S. degree, 5% earned a Ph.D., and 5% earned a D.V.M. degree.

More than three-quarters of the sample were male, and two-thirds were married at the time of the survey. Forty-seven percent of the respondents reported employment in agribusiness (as defined by the respondents), 31% were employed in nonagricultural positions, and 17% were engaged in either farming or ranching. Over 50% of the alumni were employed by the private sector, 22% were in government jobs, and 20% were self-employed.

The Importance of Career Skills

Survey respondents were asked to react to the statement, "The following skill is important to me in my current position," for the nine skills reported in table 2. The skills are listed in order of reported importance, and all nine categories were found to be relatively important. This result could be due to their generality. The results of Morrison and Edwards also demonstrated that survey respondents were likely to agree with the importance of a range of skills that were broadly defined.

Oral communication and people skills led the list as competencies that agriculture alumni considered to be most important in their current positions. For these two categories, the small number of respondents who disagreed or strongly disagreed was striking. This result confirmed similar findings by Litzenberg and Schneider in their study of agribusiness firms' ranking of the desirability of employee skills, in which interpersonal characteristics and communication skills were rated highest.

Broder and Houston, and Byler and Lamberth provided parallel results, whereas Riesenbergs' study found that decision-making capabilities outweighed the need for communication skills among University of Idaho graduates. However, problem solving, an ability similar to Riesenbergs' "decision-making capability" was also important to K.S.U. alumni.

College graduates were often employed in positions that required the management of people and time. The alumni who replied were in general agreement that management skills are meaningful in the workplace. Written communication, technical knowledge, and mathematics were found to be important for a majority of graduates, although less so than oral communication and people skills. This result was anticipated, because of the diversity of occupations that agricultural graduates pursued. For example, many jobs in sales, personnel, or management may make less use of written communication or mathematics than more technical positions.

Given the recent explosion in the use of microcomputers, the importance of computer skills among survey respondents was lower than expected. Computers can be usefully implemented in a wide variety of occupations, from hog production to construction or fertilizer sales. Respondents may have placed lower priority on computer skills because of the lack of computers in many firms. Adoption of computer technology is often delayed because of the high cost of purchasing equipment. As technological change lowers these costs and information concerning the benefits of computers is disseminated, computer use and the importance of computer skills are expected to increase.

Economics skills received the lowest relative rank of importance, possibly reflecting the types of jobs held by recent graduates. Economics skills may be job-specific

Table 1. Field of Study of K.S.U. Agriculture Alumni Survey Respondents.

Major Field of Study	Number	Percent
Agricultural Economics	288	18.7
Agricultural Education	104	6.8
Agricultural Journalism	26	1.7
Agricultural Mechanization	47	3.1
Agronomy	155	10.1
Animal Sciences and Industry ¹	429	27.9
Bakery Science and Management	26	1.7
Crop Protection	21	1.4
Dairy Production	21	1.4
Entomology	11	0.7
Feed Science and Management	40	2.6
Food Science	38	2.5
Grain Science	37	2.4
Horticulture	129	8.4
Horticultural Therapy	24	1.6
Milling Science and Management	51	3.3
Natural Resource Management	50	3.2
Park Resource Management	18	1.2
Plant Pathology	4	0.3
Poultry Science	3	0.2
Retail Floriculture	4	0.3
Other	8	0.5
No Answer	5	0.3
	1539	100.0

¹Includes Pre-Veterinary Majors (n=75).

Table 2. Importance of Skills in Current Positions of K.S.U. Agriculture Alumni Survey Respondents.

Skill	Response						Mean ¹	Standard Deviation
	Strongly Agree	Agree	Not Sure	Strongly Disagree	Disagree	No Answer		
	----- n ----- (%) ²							
Oral Communication	1157 (76.4)	326 (21.5)	15 (1.0)	12 (0.8)	4 (0.3)	25	1.731	0.449
People Skills	1089 (71.9)	365 (24.1)	42 (2.8)	12 (0.8)	6 (0.4)	25	1.664	0.597
Problem Solving	1019 (67.4)	428 (28.3)	35 (2.3)	23 (1.5)	6 (0.4)	28	1.609	0.292
Management Skills	888 (58.7)	493 (32.6)	85 (5.6)	38 (2.5)	9 (0.6)	26	1.463	0.304
Written Communication	851 (56.7)	511 (34.1)	57 (3.8)	69 (4.6)	12 (0.8)	39	1.413	0.526
Technical Knowledge	770 (51.1)	522 (34.6)	139 (9.2)	63 (4.2)	13 (0.9)	32	1.309	0.406
Mathematics	448 (30.0)	769 (51.4)	146 (9.8)	103 (6.9)	29 (1.9)	44	1.006	0.561
Computer Skills	498 (33.3)	569 (38.0)	200 (13.4)	166 (11.1)	63 (4.2)	43	0.851	0.268
Economics Skills	406 (27.1)	620 (41.4)	257 (17.2)	172 (11.5)	43 (2.9)	41	0.784	0.460

¹ Average response, with the responses defined as SA=2, A=1, NS=0, D=-1, and SD=-2.

² Percent of total respondents for each question, excluding the category, "No Answer."

compared to the ability to communicate and get along with others, which are general to almost all trades.
The Relationship between Importance of Skills and Field of Study

Although the overall results discussed in the previous section demonstrate the importance of skills among all graduates, the diversity of occupations within the agricultural sector gives rise to the question, "What skills will be

the most important for students in my classes?" To make better use of the survey results, it is desirable to uncover the statistical relationship between the importance of skills and the major field of study of the respondents. Multinomial logit analysis was utilized to provide teachers and advisors more specific information concerning the skills that graduates of each field of study found useful. Details of the econometric procedure are found in Maddala.

Table 3. Statistical Relationships Between Major Field of Study and the Importance of Skills Used After Graduation: Multinomial Logit Results.^{1,2}

Major	Skill							
	Oral Communications	People Skills	Problem Solving	Written Communication	Technical Knowledge	Mathematics	Computer Skills	Economic Skills
Ag Economics					[-]***	[+]*	[+]***	[+]***
Ag Education	[+]*			[+]**			[+]***	
Ag Journalism			[-]**	[+]***	[-]***	[-]***	[+]***	[-]**
Ag Mechanization	[-]**			[-]*			[+]*	
Agronomy	[-]**						[+]***	
Bakery Science					[+]**		[+]***	[-]***
Crop Protection					[+]***			
Dairy Production							[-]***	[+]**
Entomology							[+]*	[-]***
Feed Science					[+]*		[+]*	
Food Science				[+]**	[+]**		[+]***	[-]***
Grain Science					[+]**			[-]***
Horticulture			[-]***	[-]***				[-]***
Horticulture Therapy		[+]**		[+]*	[-]**	[-]***		[-]***
Milling Science								[-]***
Natural Resource Management				[+]***		[-]**		[-]***
Park Resource Management				[-]***			[-]**	[+]***
Plant Pathology					[+]***			[-]**
Retail Floriculture				[-]**	[-]**			

¹ Animal Sciences and Industry, including Pre-Vet majors, is the default category in each regression. Poultry Science was not found to be statistically significant in any of the regression trials and is, therefore, omitted from the table. The category "Management Skills" was not statistically related to any of the major fields of study and was also deleted from the table.

² "****" indicates significance at the 0.01 level, "***" indicates statistical significance at the 0.05 level, and "**" indicates statistical significance at the 0.10 level.

A multiple regression was estimated for each of the nine skills included in the survey, yielding statistically significant relationships between each skill and the 22 fields of study within the College of Agriculture at K.S.U. The procedure mandates that one of the major fields be designated as a "default" (reference) category. Animal Sciences and Industry was selected as the reference category because it was the field with the largest number of survey responses.

The results of the analysis, presented in table 3, should be interpreted as being significantly different than the reference category, Animal Sciences and Industry. For example, the "+" corresponding to Agricultural Economics in the mathematics skill category means that graduates with a degree in Agricultural Economics have a greater probability of agreeing that mathematics is important to them in their current job relative to graduates with a degree in Animal Sciences and Industry. The level of statistical significance is indicated by the number of asterisks, as explained in the table.

Relative to Animal Sciences and Industry graduates, Agricultural Economics graduates are more likely to pursue careers that are quantitative in nature, as indicated by the results that demonstrate a positive relationship between the importance of mathematics, computer, and economics skills. Economics is a social science, and careers in economics typically make use of broad knowledge rather than specific technical knowledge, as the logit results illustrate.

It came as no surprise that Agricultural Education majors were more likely to rank written and oral communication skills as more important than were majors in the reference category. Alumni who studied journalism made more use of written communication and computer skills, but placed less significance on the more technical skills of mathematics, problem solving, technical knowledge, and economics skills. The Agricultural Mechanization program placed graduates in positions where computer skills were relatively important, but people skills and communication skills were less essential than in the reference field of Animal Sciences.

Agronomy is a technically oriented field, yet graduates with an Agronomy degree do not appear to have made significantly more (or less) use of technical knowledge than the Animal Sciences majors. However, more importance was placed on computer skills, and oral communication skills were less influential. The related fields of Crop Protection and Plant Pathology were associated with greater use of technical knowledge, however.

Programs in Bakery, Feed, Food, and Grain Sciences are rigorous and highly technical and have been characterized recently by expanding enrollments and high starting salaries in several Land Grant Universities (U.S.D.A.). Graduates with degrees in these programs placed more emphasis on the importance of both computer skills and technical knowledge relative to graduates with an Animal Sciences degree. Graduates in the related field of Milling Science were associated with less importance placed on economic skills than graduates of Animal Sciences.

Horticulture alumni placed less importance on problem solving, written communication, and economic skills than alumni in the reference category. Horticultural Therapy and

Retail Floriculture graduates placed relatively less importance on technical knowledge. Horticultural Therapy alumni indicated greater value in people skills and written communication. Graduates in both Natural Resource and Park Resource Management made less extensive use of mathematics and economics than did Animal Sciences and Industry degree recipients, but Natural Resource Management alumni used written communication and Park Resource Management alumni used computer skills relatively more than alumni in the reference category.

The few Dairy Production majors are the only respondents other than agricultural economists for whom economics skills were statistically more important than for the reference group. Entomologists found computer skills more worthwhile and economics skills less worthwhile than did graduates of Animal Sciences and Industry.

Conclusions and Implications for Teaching

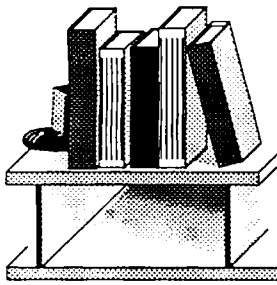
A major conclusion of this research is that over 97% of the responding alumni of the College of Agriculture at K.S.U. found communication skills to be important in their current positions. The implication of this finding is that agricultural teaching programs could be strengthened by increasing the communication content in specific courses and the overall curricula. Recent articles in the NACTA Journal were devoted to the incorporation of communication and problem solving skills into college curricula (Cobia and Gamon are examples).

People skills were also found to be useful to a large majority of recent agricultural graduates. The ability to deal effectively with others may be difficult to teach in the classroom and may be most easily learned through extracurricular activities and interaction with other students. However, Knight emphasizes the influence that teachers can have on student development within a classroom environment by providing a positive role model.

Computer skills appeared to be important, but less so than communication and people skills. This result was encouraging from the standpoint that the workplace is not totally depersonalized for a majority of agriculture graduates (people are more important than machines, at least at the time of the survey!). Curricula modification in the past several years has reflected the increasing use of computers through the adoption of computer courses within agricultural teaching programs.

In a study of future curriculum emphasis, Riesenberg recommended that Colleges of Agriculture should "...determine if the statistically significant differences, based on major, in the respondents indications of the emphasis to be placed on areas of accounting, business and economics, agricultural marketing, written communications, and oral communications and public speaking are also of practical significance, and determine the consequences of those differences." The research reported here has addressed these recommendations directly, by finding the statistical relationships between the career skills utilized while on the job (the "practical significance" of Riesenberg) and the graduates' major field of study.

Much diversity existed in the importance of skills across



Book Reviews

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

Lowell D. Hill. *Grain Grades and Standards: Historical Issues Shaping the Future*. University of Illinois Press, 1990. 424 pp. Hardbound \$39.95.

In 750 B.C., the prophet Amos expressed appall when merchants included screenings and sweepings with their wheat. Thus, problems with grain quality has a distant historical underpinning. More than two-thousand years

Barkley (continued from previous page).

major fields of study. Graduates of several specialized fields including Bakery, Food, and Grain Sciences and Plant Pathology placed importance on technical knowledge, as anticipated, but placed less emphasis on economics skills. On the other hand, some fields of study were associated with greater importance for economics skills (Agricultural Economics and Dairy Production) and less importance for technical knowledge (Agricultural Economics, Agricultural Journalism, Horticultural Therapy, and Retail Floriculture). Computer skills were more important to graduates of 11 of the 20 majors relative to the reference category of Animal Sciences and Industry.

The skills considered in this study were ranked quite differently by graduates of the various fields of study, reflecting the wide divergence in occupations pursued by agricultural alumni. The results presented here can be used to target teaching efforts toward the skills that are found to be important to graduates within each particular discipline.

References

- Broder, J.M. and J.E. Houston. "Employer Assessment of Graduates." *NACTA Journal* 30-2(1986):18-22.
- Byler, B.L. and E.E. Lamberth. "Using Alumni Follow-up Studies for Program and Curricular Improvements." *NACTA Journal* 32-2(1988):30-33.
- Cobia, D.W. "The Ways and Hows of Incorporating Writing into Agricultural Courses." *NACTA Journal* 30-2(1986):22-25
- Coulter, K.J., M. Stanton, and A.D. Goecker. *Employment Opportunities for College Graduates in the Food and Agricultural Sciences*. Higher Education Programs, U.S.D.A. and Texas A&M University (1986).
- Gamon, J. "Teaching Communication Skills in the Agriculture Classroom." *NACTA Journal* 32-1(1988):23-26.
- Knight, J. "7 Strategies for Improving Instruction." *NACTA Journal* 32-1(1988):13-16.
- Litzenberg, K.K. and V.E. Schneider. "Educational Priorities for Tomorrow's Agribusiness Leaders." *Agribusiness: An International Journal* 4-2(1988):187-195.
- Maddala, G.S. *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge: Cambridge University Press, 1983.
- Morrison, M.R. and M.R. Edwards. "'The Right Stuff' for Productivity in Agribusiness Employment." *Agribusiness: An International Journal* 3-4(1987):377-383.
- Riesenberg, L.E. "Future Curriculum Emphasis for Colleges." *NACTA Journal* 32-2(1988):34-37.
- United States Department of Agriculture. Office of Public Affairs. *Selected Speeches and News Releases*. January 11, 1989, and June 8, 1989.

later, Senator Hubert H. Humphrey, during a 1975 congressional hearing stated, "Under the present regulations, exporters have deliberately added flour sweepings or cheap grain to the limit of the grading tolerances." The grade standards and quality controversies continue to the present.

Current grades and standards have grown out of the economic need to facilitate rapid and efficient exchanges of bulk commodities in widely dispersed markets without individual inspections on site. Some industry participants also seek standards that will reflect the intrinsic value of grain. In significant detail, Lowell D. Hill provides a clear account of the history of grain grading and standards in the United States, from the beginning of U.S. commercial markets through legislative proposals and industry actions of 1988. This text represents the author's decades of experience with grain grades and qualities. Hill's experiences range from sampling ocean-going cargo vessels and monitoring quality changes from farmers' trucks to foreign processing plants, to conducting hearings on grain grades and standards development. In eight chapters, Hill meticulously documents a historical review of grain grading standards and inspections, the present state of the industry, and a description of a possible strategy for developing ideal grades and standards in the future. To demonstrate just how complete this text is, Hill ends his chapters with a total of 1,005 notes.

Voluntary grain grading systems were tried in various forms at numerous places and for various commodities, until the Grain Standards Act of 1916 placed the responsibilities of developing, implementing, reviewing, and modifying grain grading standards with the United States Department of Agriculture. In the first three chapters, Hill does an excellent job of setting the stage for the federal supervision and development of grain grades which followed. Chapters 4-6 examine the evolutionary process used in obtaining grain standards, proposed and implemented changes and refinements, and objective measures of quality associated with the initial grain standards issued by the USDA. These refinements and measures are categorized under topics of regulatory changes and legislative activities. As in the rest of the text, Hill provides a detailed and complete chronological account.

Hill continues with a very informative and thought-provoking chapter, "The Persistent Issues in the Search for Equitable Grades." According to Hill, despite more than 300 changes in grading standards and three major revisions of the Grain Standards Act, "the grain quality problems of 1986 were discouragingly similar to those of 1886." Recurring basic issues in debates regarding quality include: 1) perceived losses of economic values in the grain received by foreign buyers, 2) blending practices of grain handlers used to combine diverse qualities into a uniform product meeting the minimum qualities of contracts, 3) the search for measures of quality that reflect the intrinsic value for end-users, and 4) economic opportunities, incentives, and disincentives associated with regulative and legislative changes. Hill addresses each of these issues and provides a particularly good discussion of obstacles to permanent solutions to grain-quality problems.

Hill concludes with a chapter that looks to the future. He notes subtle changes in recent attitudes and actions, signaling a shift from the adversarial stance among the many participants in the industry to an attitude of cooperation which might lead to longer-term solutions for recurring issues. The Grain Quality Improvement Act of 1986 reflected these changing attitudes toward the purposes of grades and standards. The author ends by presenting an interesting strategy for developing ideal grades and standards. Although this strategy is admittedly based on his personal philosophy, Hill provides an intriguing discussion based on his many years of academic and "hands-on" work in grain grades and quality standards and reflecting his extensive scientific and technical knowledge.

In conclusion, Lowell Hill has produced a clear, thorough, and well-written text. Due to its specificity and detailed nature, I would not expect this work to be the primary text for traditional agricultural marketing classes. However, I highly recommend Hill's work as a reference for anyone teaching courses in grain marketing, quality standards, and policy.

Danny E. Terry
Associate Professor of Agricultural Economics
Central Missouri State University

William F. Bennett, Billy B. Tucker, A. Bruce Maunder. *Modern Grain Sorghum Production*. Iowa State University Press. 169 pp. Hardbound.

This book has been produced as a general coverage of grain sorghum production for anyone who is interested. The authors have made the forego- ing statement of their objective as well as the statement that they have drawn