Perceptions of Agriculture and Natural Resource M.S. Graduates Regarding Program Quality and Learning Outcomes Attainment

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Abstract

Master's degree recipients from the College of Agriculture, Food and Environmental Sciences (CAFES) at Cal Poly State University were surveyed to assess 1) their satisfaction with the M.S. program, and 2) the extent to which key learning outcomes were attained. Emphasis was placed on the graduate's perception of the value of their thesis or creative project experience in developing technical competency and skills in communication, critical thinking, problem-solving, leadership, and decision making.

CAFES M.S. alumni were generally positive in their perception of the graduate program, though written comments indicated dissatisfaction with various program aspects among some graduates. Most respondents felt their professionally related skills (e.g. communication, leadership, problem-solving, etc.) were enhanced by their graduate school experience.

Students who completed a thesis reported significantly higher levels of skill development in writing, analytical methods, and research competency, compared to non-thesis students. Further, the educational value and challenge of a written thesis were considered significantly greater by students than for creative projects or internships.

Most respondents were satisfied with faculty mentoring and considered the M.S. program helpful in career advancement.

Introduction

Colleges and universities have widely adopted the process of learning outcomes assessment, as described by Huba and Freed (2000). This focus on outcomes of educational programs has been driven by federal legislation (Belcher et al., 1996), the W.K. Kellogg Foundation (Suvedi and Heyboer, 2004), higher education professional organizations (AAHE, 1997), accrediting bodies (Western Association of Schools and Colleges, 2000), and the colleges and universities themselves.

Miller et al. (1998) described a model for assessing undergraduate student learning outcomes in the Agricultural Systems Technology program at Iowa State University. Their sampling instrument, a graduate follow-up (alumni) survey, has been applied to many other undergraduate agriculture and natural resource programs, most recently in New Mexico (Dormody and Torres, 2002), Michigan (Suvedi and Heyboer, 2004), and North Carolina (Wilson et al., 2004). A graduating senior survey has been required for Iowa State University Agribusiness seniors to generate similar learning outcome data (Dieter, 2003). Employers of recent agricultural college graduates were also surveyed to directly assess student's key competencies in key skill and knowledge areas (Cole and Thompson, 2002; Suvedi and Heyboer, 2004).

Few outcomes-based assessments of graduate programs in agriculture and natural resources have been published, though Miller et al. (1998) surveyed Master of Agriculture (non-thesis) graduates from Texas A&M to determine their satisfaction with the degree program. In an assessment of agricultural education graduate student's writing skills at Texas Tech, Texas A&M, and Oklahoma State universities, Lindner et al. (2004) found that a majority of students were deficient in one or more key writing competencies.

The purpose of this study was to assess the strengths and weaknesses of the CAFES M.S. program at Cal Poly, as perceived by alumni of the program over a ten year period (1994-2003). A major theme of the study was to assess the degree to which culminating written experiences (thesis or creative project report) helped graduate students attain key learning outcomes.

Materials and Methods

Program Background

The agriculture graduate program at Cal Poly consists of M.S. degrees in Agriculture, with various specializations, M.S. degrees in Agribusiness and

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Forestry Sciences (both new in 2003), and jointly administered agricultural M.B.A. (with College of Business) and Water Engineering M.S. (with College of Engineering) programs. Approximately 135 M.S. students are enrolled in graduate coursework each year, with another 200 students in good standing (e.g. writing their thesis) but not currently enrolled in courses.

All CAFES M.S. students, except those in our Agricultural Education & Communication (AE&C) and General Agriculture specializations, are required to write a formal thesis. AE&C students conduct a graduate internship, usually in curriculum development while teaching high school agriculture, to satisfy the culminating experience requirement for their degree. General Agriculture candidates may write a traditional thesis or participate in an internship or other supervised, graduate-level creative project. Such internships and projects have included planning and conducting wine industry events, analyzing logging mill business plans, and developing marketing plans for various California agribusinesses. Some CAFES faculty questioned the comparative value of the thesis vs. non-thesis options, which consequently became a major emphasis in our alumni survey.

CAFES Graduate Program Learning Outcomes assessment

In response to the Western Association of Schools and Colleges' (WASC 2000) latest review of Cal Poly academic programs in 2000, as well as campus and Chancellor's office initiatives, each college was asked to develop a specific assessment plan, focused on student learning outcomes, for all academic programs. Effective learning outcomes assessment requires clearly defined program mission and goals statements (Allen et al., 2002). In 2004, our graduate program mission and goals statements were written in consultation with faculty associated with graduate education and are listed below.

CAFES graduate program mission statement

"It is our mission to equip graduates with the necessary skills and knowledge to be effective leaders in agricultural and natural resources professions."

CAFES graduate program goals

The CAFES graduate program goals identify five competencies considered essential for successful completion of the M.S. degree. These are:

1. Develop technical knowledge and integration competencies
2. Develop critical thinking/problem solving competencies
3. Develop effective oral and written competencies
4. Develop social, leadership, and decision-making competencies
5. Develop independent analytical, research, and creative competencies

College-wide assessment plan

The College of Agriculture management staff (deans and department heads/chairs) conferred with faculty to develop an assessment plan including seven learning outcomes considered central to all CAFES programs (listed below). We selected four of these learning outcomes (bolded and with asterisks) that were directly related to the graduate program goals to assess in the M.S. alumni survey.

College-Wide Learning Outcomes - We wish to provide programs and a learning environment that result in graduates who possess the following:

- Technical Competency in the Respective Discipline*
- Effective Communication Skills*
- Awareness of the Impact of Technology on Society
- Understanding of Ethics and Professional Conduct
- Strong Interpersonal and Teamwork Skills
- Leadership/Planning/Decision-Making Skills*
- Critical Thinking/Complex Problem-Solving Skills*

*Selected Learning Outcomes to be assessed in M.S. program review

Survey Methodology

The sample population included all CAFES M.S. graduates (a census) who completed their degrees between 1994 and 2003. A data output request was submitted to Cal Poly's Advancement office, resulting in the names, addresses and phone numbers of 295 CAFES M.S. alumni, 1994-2003. Of these master's degree graduates, 101 had completed a thesis, while 194 completed a creative project or graduate internship. A survey questionnaire was developed with input from a Cal Poly statistical consultant and an assessment specialist. Responses to this survey served as an indirect measure of learning outcomes assessment (Allen et al., 2002).

Each questionnaire consisted of five general questions, 12 thesis/creative project questions, and three other program related questions. General questions covered the area of degree specialization, availability of financial aid, adequacy of facilities, and whether a thesis or creative project was completed. Thesis/creative project questions were Likert-style with five choices. Other program related questions addressed the perceived quality of faculty advising, and the impact of completing the M.S. degree on career success. Following the closed-end questions, M.S. alumni were given the opportunity to add additional, open-ended comments to the survey response form. The objective in designing the questionnaire was to gain some general feedback on program quality, as well as specific responses related to the four key learning outcomes of interest in this program review. An additional goal of this survey was to compare the responses to questions related to

specific skill development from M.S. alumni in thesis-based specializations with those not completing a thesis.

Questionnaires were surface-mailed to each M.S. alumnus with a cover letter and postage-paid, business reply envelope, numbered sequentially for tracking purposes and data analysis. Within the week following the mailing, all 295 alumni were phoned to encourage response. 120 completed questionnaires (40% yield) were received, with 20 returned as undeliverable by the post office, presumably due to alumni having changed mailing addresses.

Survey Data Analysis

All survey results were treated confidentially, and responses coded and entered into an Excel® spreadsheet for calculating response frequencies. Responses to thesis-creative project/program-related questions were statistically analyzed using contingency tables and Chi-square tests for association (Minitab 14®, Minitab Inc., 2003) in order to determine whether M.S. graduates in thesis-based and non-thesis programs viewed their attainment of learning outcomes differently. The survey data consisted of ordinally ranked responses to Likert-type questions. Like survey response categories were combined to increase the number of observed values in order to avoid the problem of insufficient cell frequencies. Response categories "Not at all" and "Minimally" were combined and designated a placeholder value of 1, "Somewhat" was given a 2 value, and "Significantly" and "Greatly" were indicated by the value 3. These non-parametric data required cross-tab analysis so that Pearson Chi-Square values could be determined.

Table 1. M.S. Alumniz Survey Responses by Degree

M.S. Degree Specialization	No. Respondents (N=120)	Thesis	Non-Thesis
Agribusiness	1	1	0
Agricultural Engineering Technology	2	2	0
Agricultural Education	52	0	52
Animal Science	1	1	0
Forestry & Natural Resources	4	4	0
Crop Science	4	3	1
Dairy Products Technology	5	5	0
Environmental Horticulture	1	0	1
Food Science & Nutrition	7	7	0
International Agriculture Development	1	1	0
Irrigation	2	2	0
Recreation Administration	1	0	1
Soil Science	5	5	0
General Agriculture	30	20	10
Other	4	2	2

[z]1994-2003 graduates

Table 2. Survey Respondent's Financial Aid

Form of Financial Aid Received	No. of Respondents (N=38)
Research Assistantship	11
Teaching Assistantship	5
Lecturer Appointment	1
Scholarship	2
Hourly Work (related to graduate work)	16
Other	3

Results and Discussion

The survey respondents identified their M.S. degree specialization across 14 areas of our graduate program, including four individuals who were unclear as to which M.S. specialization they belonged (Table 1). Nearly half (52) of the respondents were alumni of the Agricultural Education M.S. specialization, with another large group (30) associated with the General Agriculture specialization. Until recently, most CAFES graduate students enrolled in one of these two areas, though the trend has moved towards increasing specialization. Of the survey's 120 respondents, 45 completed a thesis, while 75 completed a creative project or graduate internship.

When asked about financial aid, 32% of survey respondents indicated having received a research assistantship, teaching appointment (as Graduate Teaching Associate or Lecturer), scholarship, or other paid work during their graduate studies (Table 2). Research assistantships and hourly paid employment were the most commonly cited forms of financial support.

CAFES M.S. alumni were generally positive about the degree to which their thesis or creative project work helped them attain stated learning outcomes (Table 3). For example, 63% of respondents felt their technical skills (e.g. field practices, statistics, lab research methods, etc.) were enhanced substantially ('significantly' or 'greatly' improved) as a result of their M.S. work. There was no significant difference in response from thesis vs. non-thesis graduates as to their perception of technical skill attainment (Chi-Square=4.16, DF=2, $p<0.12$). A significantly higher percentage of thesis-program alumni felt their writing skills were enhanced compared to their non-thesis counterparts (Chi-Square=11.08, DF=2, $p<0.00$). This result is not surprising, given the writing-intensive process involved with a thesis, compared to the usually less formalized writing of a curriculum proposal or other creative activity for non-thesis students.

Speaking skills were considered the least improved of all learning outcomes addressed in our survey, with only 32% of respondents indicating

'significant' or 'great' skill improvement as a result of their thesis or creative project work. There was no significant difference in responses from thesis vs. non-thesis graduates as to their perception of speaking skill attainment (Chi-Square=2.71, DF=2, p<0.26). The majority of respondents indicated that their leadership skills were enhanced as a result of their thesis or creative project work, though differences in perceived leadership skill attainment between thesis and non-thesis graduates were nonsignificant (Chi-Square=4.150, DF=2, p<0.13). Nearly half (48%) of graduates replied that their management skills were 'significantly' or 'greatly' enhanced as a result of their thesis or creative project work. However, there was no significant difference in responses from thesis vs. non-thesis graduates as to their perception of management skill attainment (Chi-Square=3.32, DF=2, p<0.19). In the case of both leadership and management skills, mean and median responses from non-thesis graduates were numerically higher than from graduates of thesis-based programs (Table 3). This may be due to a greater degree of emphasis on leadership and management skills in the Agricultural Education M.S. program than in the more technical specializations.

About half (52%) of M.S. alumni responded that their decision-making skills were substantially improved by virtue of completing a thesis/creative project. There was no significant difference in responses from thesis vs. non-thesis graduates as to their perception of decision-making skill attainment (Chi-Square=0.84, DF=2, p<0.66). All but 14% of respondents reported improvement in their analytical methods skills as a result of their thesis/creative project work, which included 54% who indicated substantial improvements. The Chi-Square analysis revealed that a significantly higher percentage of thesis program graduates felt their analytical skills were enhanced compared to their non-thesis counterparts (Chi-Square=6.82, DF=2, p<0.03). Like "analytical skills," the ability to recognize problems in one's discipline was generally enhanced for CAFES M.S. alumni: 84% reported at least some improvement in this skill, with nearly 50% indicating substantially improved ability. However, there was no significant difference in responses from thesis vs. non-thesis graduates as to their perception of problem recognition skill attainment (Chi-Square=2.42, DF=2, p<0.29). Over 80% of respondents reported improvement in their ability to formulate hypotheses as a result of their thesis/creative project work, which included 54% who indicated substantial improvements. There was no significant difference in responses from thesis vs. non-thesis graduates as to their perception of hypothesis formulation skill attainment (Chi-Square=5.03, DF=2, p<0.08). This is a surprising result, given that formulating hypotheses is a key function of most thesis research, and not usually involved in creative activities.

Finally, nearly 75% of respondents found they were better at applying research methods to proposed problems as a result of completing a thesis or creative project. Not surprisingly, the Chi-Square analysis revealed that a significantly higher percentage of thesis program graduates felt their research skills were enhanced compared to their non-thesis counterparts (Chi-Square=11.85, DF=3, p<0.00). From these results, it appears that the rigor and structure of conducting research leading to a thesis provides higher levels of learning outcome attainment in a variety of skill areas.

In addition to responding to questions related to specific learning outcomes, M.S. alumni answered two other Likert-style questions related to the educational value and challenge of their thesis or creative project experience. Over 80% of alumni reported that their thesis or project experience was educationally valuable. Chi-Square analysis revealed that a significantly higher percentage of thesis program graduates felt their thesis experience was educationally helpful, compared to their non-thesis counterparts (Chi-Square=6.89, DF=1, p<0.00). Nearly half (49.2%) responded that the thesis or project experience was challenging, though a significantly higher percentage of thesis program graduates felt their thesis work was challenging compared to students completing a creative project (Chi-Square=7.21, DF=2, p<0.02).

When asked their opinion about the quality of faculty mentoring during their graduate work, most

Table 3. Respondent's Perceived Level of Learning Outcomes Attainment (N=120)

Learning Outcome	Mean[zy]			Median		SD	
	Thesis	Non-Thesis	Combined	Thesis	Non-Thesis	Thesis	Non-Thesis
Technical skills enhanced by thesis/creative project	3.91	3.64	3.75NS	4.00	4.00	0.87	1.02
Writing skills improved by thesis/creative project	3.69	3.07	3.29***	4.00	3.00	0.90	1.16
Speaking skills improved by thesis/creative project	3.18	3.01	3.08NS	3.00	3.00	1.07	1.23
Leadership skills enhanced by thesis/creative project	3.07	3.42	3.28NS	3.00	4.00	1.03	1.18
Management skills enhanced by thesis/creative project	3.13	3.51	3.37NS	3.00	4.00	1.10	1.09
Decision-making skills enhanced by thesis/creative project	3.58	3.49	3.52NS	4.00	4.00	0.94	1.02
Analytical skills enhanced by thesis/creative project	3.89	3.31	3.52**	4.00	3.00	0.96	1.16
Problem recognition enhanced by thesis/creative project	3.62	3.36	3.44NS	4.00	3.00	1.09	1.12
Ability to formulate hypotheses enhanced by thesis/creative project	3.79	3.23	3.42NS	4.00	3.00	1.05	1.19
Research methods skills enhanced by thesis/creative project	3.62	2.92	3.17***	4.00	3.00	0.98	1.22

[z]Not at All =1, Minimally = 2, Somewhat = 3, Significantly = 4, Greatly = 5

[y]NS, *, **, *** Nonsignificant or significant at *P=0.05, 0.01, or 0.001*, respectively using Pearson Chi-Square test for association

students (61%) reported effective faculty advising/mentoring/supervision (Table 4). The final survey question addressed the student's perceived value of their M.S. degree in attaining career success. One in five respondents found the degree provided no advantage in the job search; however 58% reported positive impact (Table 5). Much stronger effect was reported on subsequent job/career enhancement from having the master's degree, where over 63% found it a substantial aid.

Table 4. The Opinions of Agriculture M.S. Alumni towards Advising (N=118)

The extent to which your graduate advisor and committee effectively advised/mentored/supervised your graduate work	Frequency of Response	%
Not at all	6	5.08
Minimally	12	10.2
Somewhat	27	22.9
Significantly	36	30.5
Greatly	37	31.4

Written comments were received from 63 of 120 respondents (52 %) and subsequently grouped into positive (56%), neutral (24%), and negative (20%) categories. These responses were not statistically analyzed. The following verbatim comments represent common themes among the three categories of response — positive, neutral and negative.

Positive:

"The M.S. through Ag Ed was the best way to complete the M.S. program for me. I would otherwise have to quit my current job to complete a similar program at another University. Cal Poly made this possible by having a summer program."

"My M.S. program provided a solid foundation for me to move up in post-secondary positions and assisted in my decision to pursue a Ph.D. degree."

Neutral:

"If you have an advisor who helps with picking out a project that they know will work and satisfy all the requirements it really helps. The hardest part was the survey and statistical analysis. The key ingredient for a good project or thesis is the advisor and the relationship a student has with them."

"My project was perfectly designed for helping me improve my job performance. It took time, research and inspiration to complete."

Negative:

"The thesis/M.S. program in the CAFES has potential to be a good experience. However, the research infrastructure (lab space, equipment, money, colleagues) is severely lacking. Also, the course work was not rigorous."

"I did a creative project. It was a glorified 'Senior Project' and basically felt just like jumping through the same hoops as undergraduate studies. I'm glad I have an M.S. but I have no research skills to show for the project. I took the classes, wrote up a glorified senior project, prepared for the oral/written exams, paid tuition and was done. Peers perceive that an M.S. degree verifies that a research thesis has been conducted and that is a major drawback to me since I possess an M.S. that did not include research or a thesis. Many businesses and organizations today want skilled individuals to assess program validity. Based on my M.S., I'm not capable of being able to do that type of evaluation…even thought the perception is that I can because of my master's work."

A qualitative review of all written comments suggests that the majority of CAFES M.S. alumni found their graduate school experience worthwhile and challenging, with some notable exceptions, as above. As pointed out by Inskeep (2000), the challenge to instill standards for rigor and scientific quality in graduate work is as great as ever, particularly with today's agriculture graduate students coming from more diverse backgrounds.

Table 5. The Opinions of Agriculture M.S. Alumni towards Career Success (% of Respondents N=119)

	Not at All	Minimally	Somewhat	Substantially	N/A
Importance of M.S. degree in helping you get a job	22.7	5.04	17.6	36.1	18.5
Importance of M.S. degree in helping you get a better position or higher salary	5.88	8.4	17.6	63.9	4.2

Summary

CAFES M.S. alumni generally indicated that their professional skills and scholarly abilities were significantly enhanced by their graduate program experiences. Responses to certain survey questions differed significantly between thesis and non-thesis program alumni. Alumni who completed a thesis reported significantly greater improvement in writing, analytical methods, and research skills than did non-thesis seeking students. Thesis-based graduates also responded at significantly higher levels that their culminating experience (thesis) was challenging and educationally valuable, compared to the experience of non-thesis students. If these results

are common to graduate education, the requirement of a thesis may confer substantial advantages to graduates whose careers involve written communication and analytical skills.

Open-ended comments from some M.S. alumni raise questions about the level of rigor of their graduate study experience, particularly among our non-thesis options. Some other alumni appreciated the flexibility of the non-thesis degree options, which allowed them to complete their M.S. studies while working in their field. It seems important that some of our graduates feel ill-equipped to meet the career skill requirements of their current positions, and that this is attributed to their M.S. program experience. Whether or not this concern is widespread among graduates of flexible programs (e.g. distance learning or "executive degree programs") seems worth further investigation.

Most respondents were satisfied with faculty mentoring and considered the M.S. program helpful in career advancement. Only 32% of our respondents reported receiving some form of financial aid. Future studies could evaluate the extent to which financial support influences the student's perception of the overall graduate school experience.

An action plan is in place to address concerns raised in this M.S. alumni survey and overall program review. The non-thesis, General Agriculture specialization has been phased out, yearly alumni surveys will be taken to monitor student satisfaction and attainment of learning outcomes, more stringent standards for thesis and creative project reports are being discussed, and the concept of establishing a graduate faculty is under consideration. Efforts are underway to provide graduate students more consistent standards for performance in both thesis-based and non-thesis programs. Further studies into the relative value of thesis vs. non-thesis master's degree programs in student's attainment of learning objectives are needed.

Literature Cited

AAHE. 1997. Learning through assessment: a resource guide for higher education. Washington, D.C: American Association for Higher Education.

Allen, M., R. C. Noel, B.M. Rienzi, and D.J. McMillin. 2002. Outcomes assessment handbook. California State University, Institute for Teaching and Learning, Long Beach, CA.

Belcher, G., N. L. McCaslin, and W.S. Headley. 1996. Implications of performance measures and standards for evaluation and assessment in agricultural education. Jour. of Agricultural Education, 37(4):1-7.

Cole, L., and G. Thompson. 2002. Satisfaction of agribusiness employers with college graduates they have hired. NACTA Jour., 46(1):34-39.

Dieter, R. 2003. A course every department can (should?) teach graduating senior survey. NACTA Jour., 47(2):14-17.

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

Huba, M.E., and J.E. Freed. 2000. Learner-centered assessment on college campuses. Boston: Allyn and Bacon.

Inskeep, K. 2000. The challenge of graduate education in the academic environment of today and tomorrow. Proceedings of the American Society of Animal Science. Http://www.asas.org/jas/symposia/proceedings/0921.pdf

Lindner, J.R., T.H. Murphy, and G.J. Wingenbach. 2004. Written communication competencies: strengths and weaknesses of agricultural education graduate students. NACTA Jour., 48(4):31-38.

Miller, B.A., J.R. Noska, M.W. Murphey, T.R. Greathouse, J.H. Hesby, C.L. Skaggs, and W.S. Ramsey. 1998. The Master of Agriculture in the department of Animal Science at Texas A&M University: an opinion survey analysis and results comparison. NACTA Jour., 42(2):27-32.

Miller, W.W., D.L. Williams, V.A. Bekkum, and R.W. Steffen. 1998. The follow-up survey as a student outcome assessment method: some procedures and examples. NACTA Jour. 42(3):40-46.

Minitab® release 14 for Windows®. 2003. State College, PA. Minitab Inc.

Suvedi, M., and G. Heyboer. 2004. Perceptions of recent graduates and employers about undergraduate programs in the College of Agriculture and Natural Resources at Michigan State University: a follow-up study. NACTA Jour., 48 (1):22-27.

Western Association of Schools and Colleges report. 2000. Association of Senior Colleges and Universities. Accrediting Commission for Senior Colleges and Universities.

Wilson, E., J. Flowers, B. Croom, and G. Moore. 2004. Evaluating an undergraduate program using outcomes-based assessments. NACTA Jour., 48(3):19-24.